TECHNOLOGY DEPT.

Gas Journal

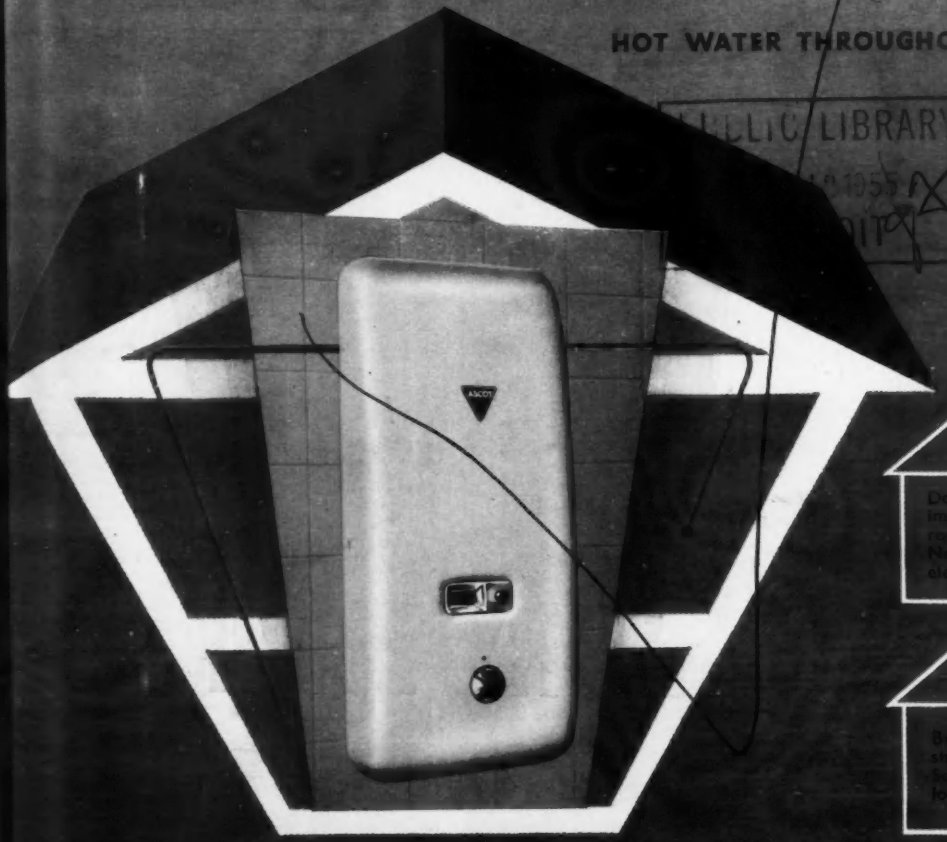
VOL. 282. 107th YEAR. LONDON, JUNE 22, 1955 Nº 4803. PRICE 1/3

ASCOT 715

BALANCED FLUE MULTIPOINT GAS WATER HEATER

HOT WATER THROUGHOUT THE HOUSE

NEVER RUNS COLD



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Beautifully designed shallow case. Stainless steel burner gives long service life.

THE ASCOT 715 HAS BEEN SPECIFIED BY OVER 50 HOUSING AUTHORITIES

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FIG. 150

modern H.P. design

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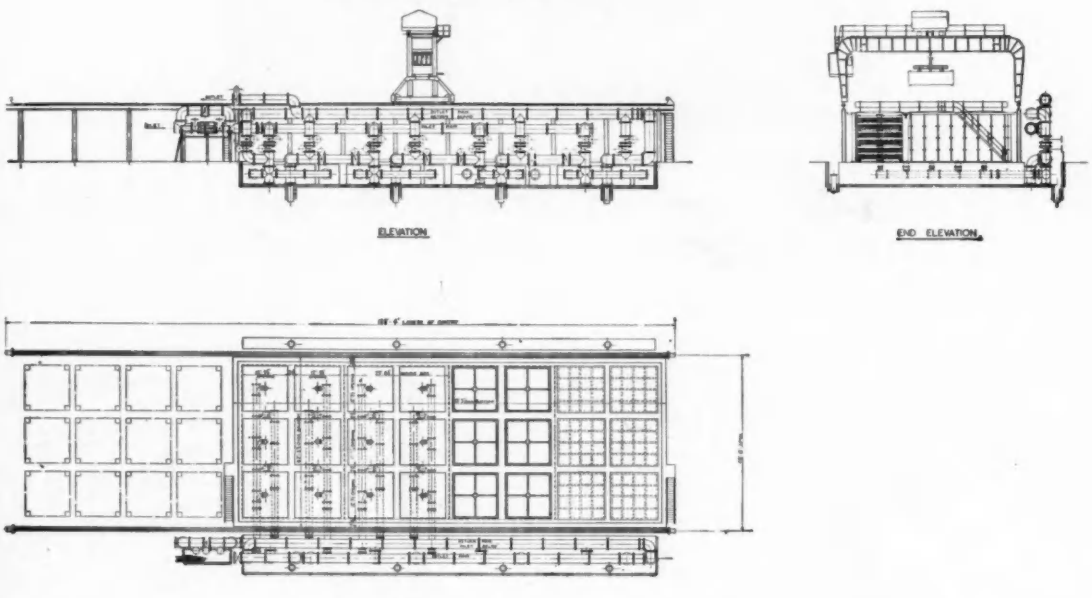
1955 (April)———53½ million cubic feet capacity

DESIGN FOR M.S. WELDED TRAY PURIFIERS.



ELEVATION

END ELEVATION

PLAN

General arrangement of the 7 million cu. ft. per day capacity **TRAY PURIFIER INSTALLATION** now in course of erection at the Portsmouth (Hilsea) Works of the Southern Gas Board, to whom we are indebted for their kind permission to publish this illustration.

TRAY PURIFIERS can be economically designed for all capacities, and can be shown to save those oxide-handling costs which have long been accepted as inevitable in dry-box purification.

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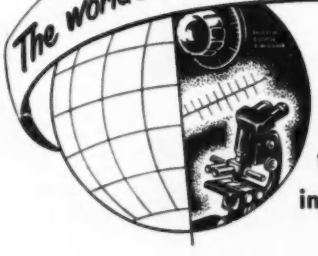

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Every field of instrumentation in Power Supply, Industry, Medicine, Research and Education is covered. You will be able to see all classes of temperature pressure and flow controllers for industrial use, electrical measurement and control, complete equipment for sea and air navigation and land surveying, scientific instruments and equipment for all laboratories, electronic instruments for all applications and precision equipment in such diverse fields as metrology, photography and engineering design.

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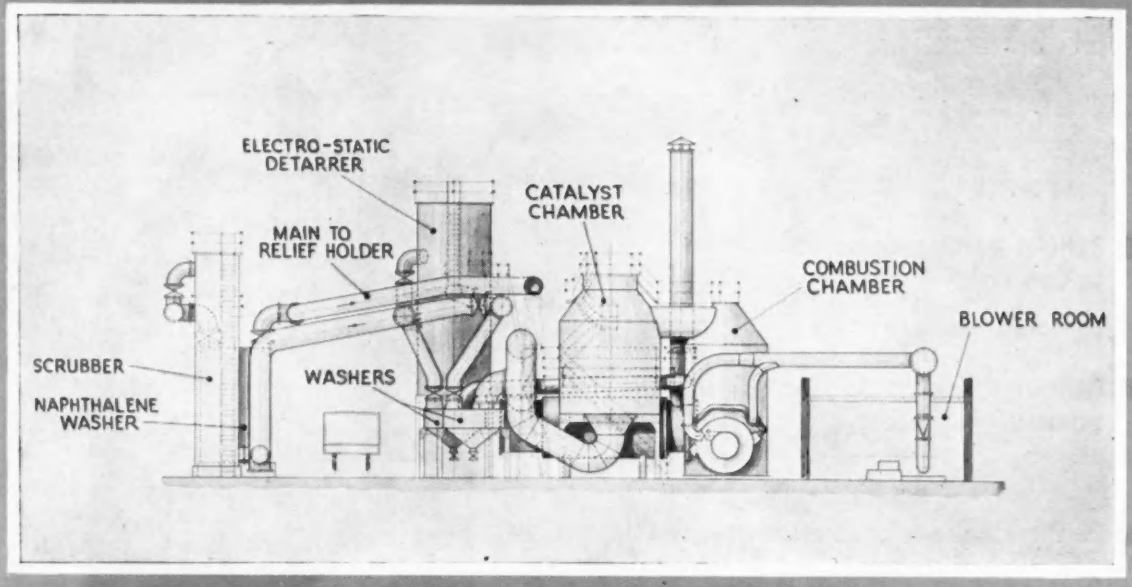
for Hilsea Gasworks, Portsmouth



The above Plant which is under construction for the Southern Gas Board, is the initial section of a proposed 8,000,000 cu. ft. per day installation.

HG

28 Onia-Gegi Catalytic Oil Gas Installations are in operation and under construction having a total capacity of over

65,000,000 CU. FT. PER DAY

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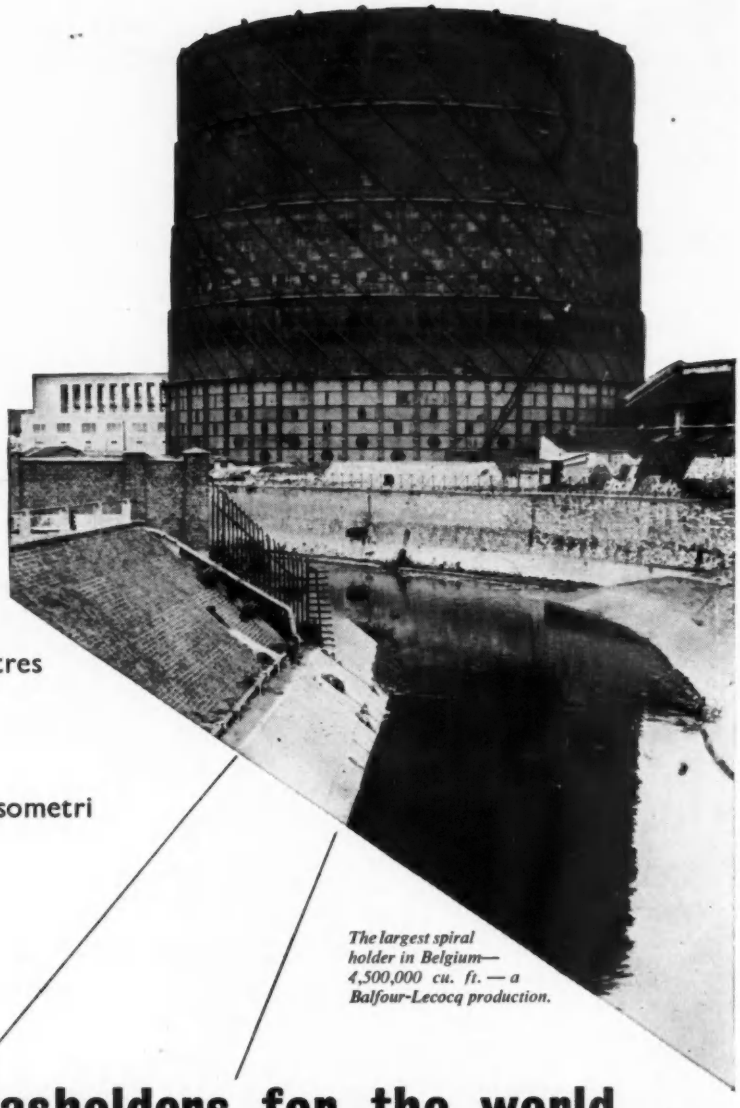

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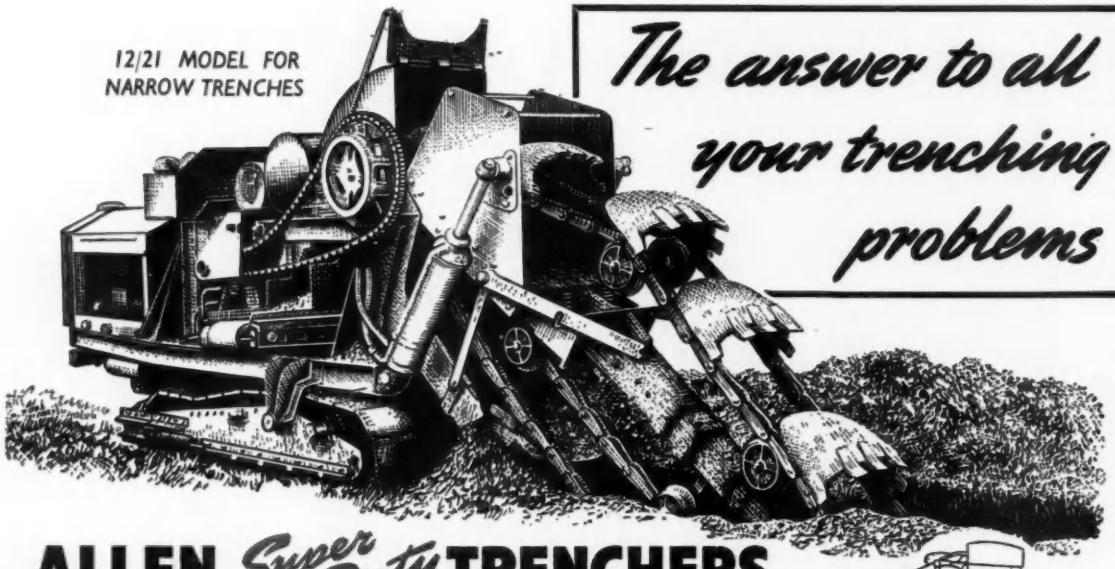

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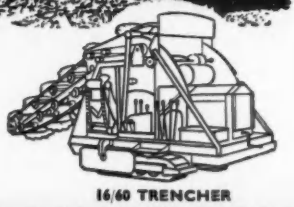

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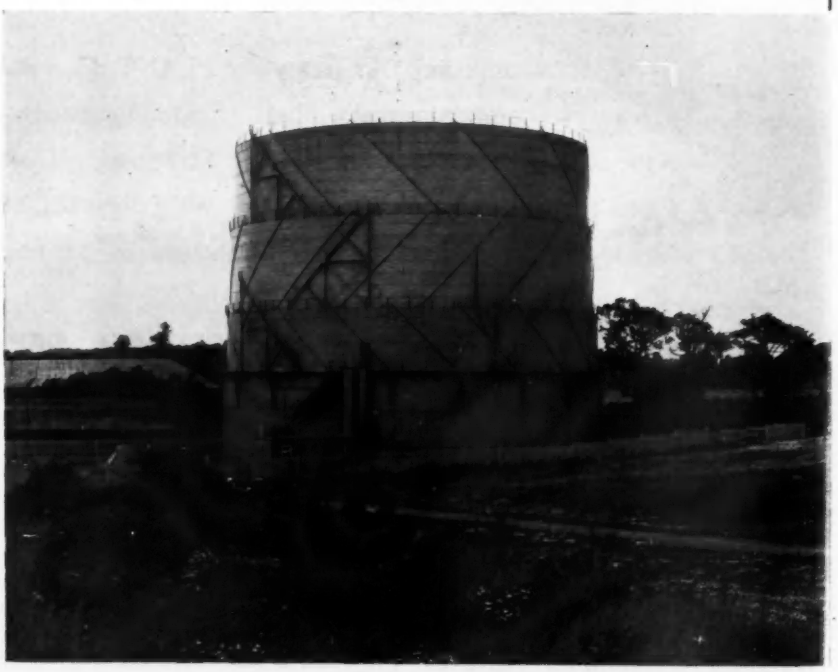

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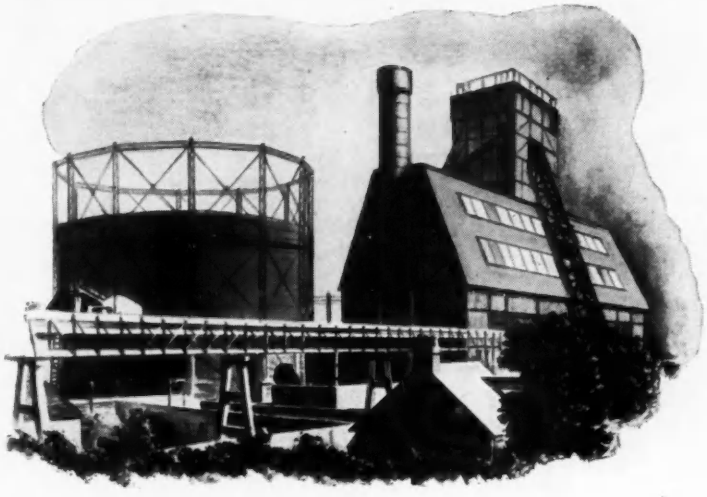

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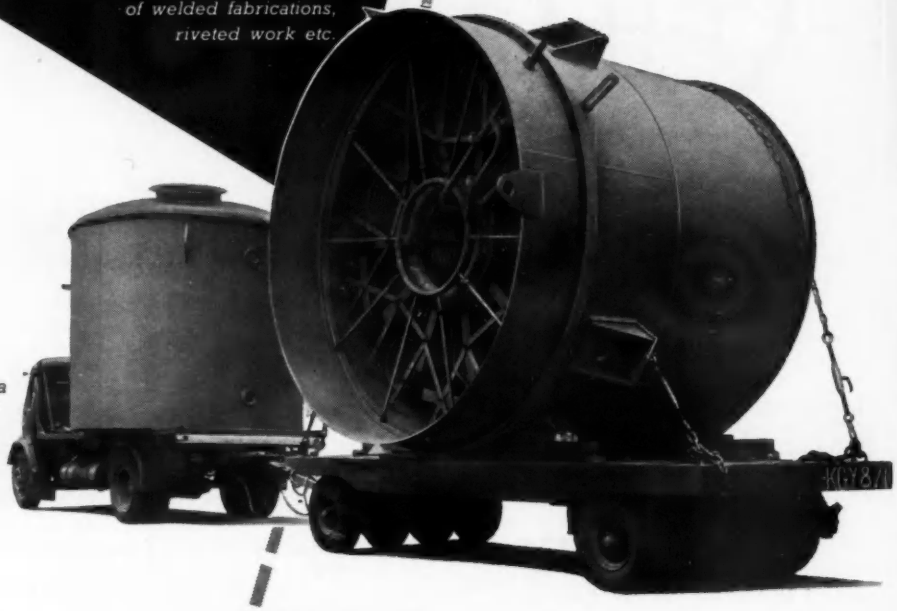
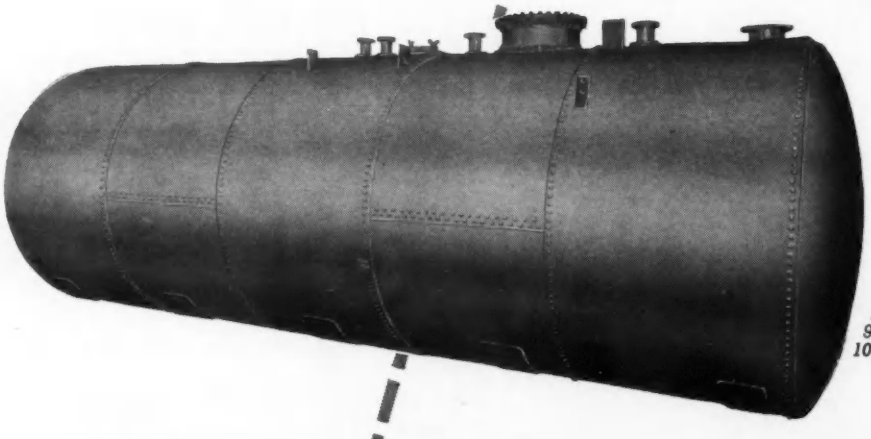


The two sections of a Deodoriser leaving our Works. Thirteen of these units have been supplied, installed and site welded at a new Refinery.



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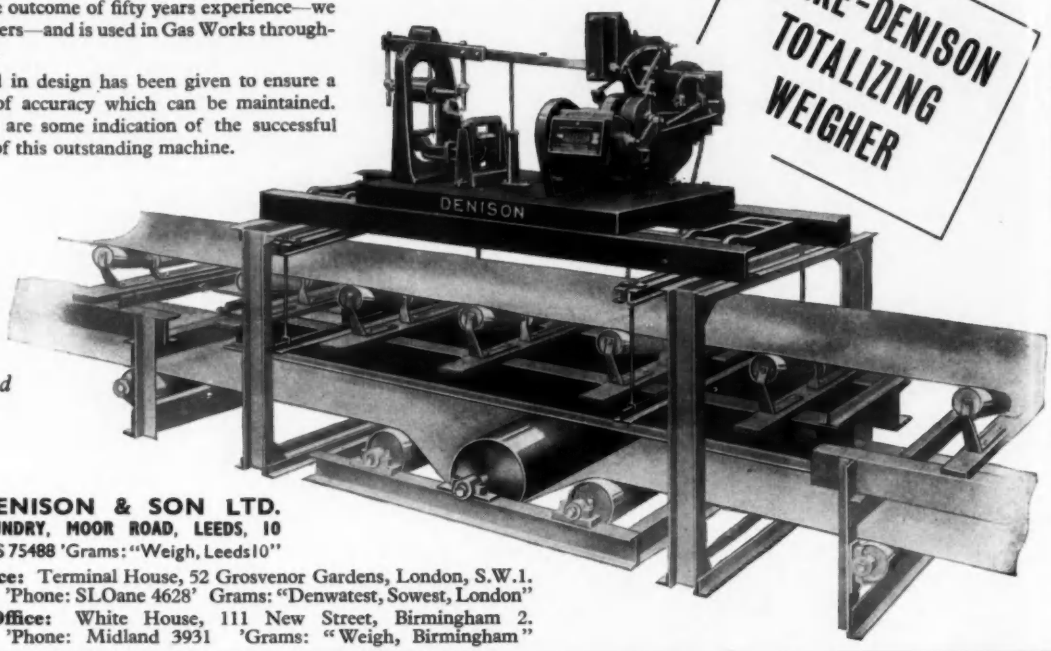

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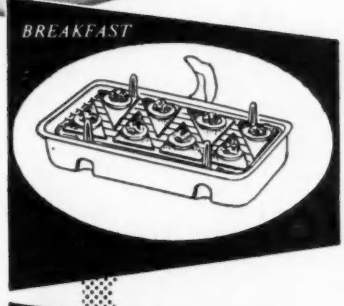
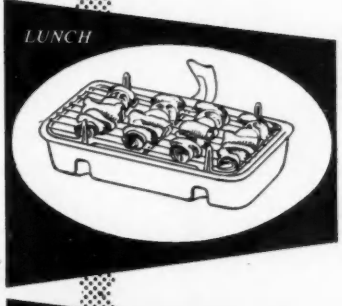


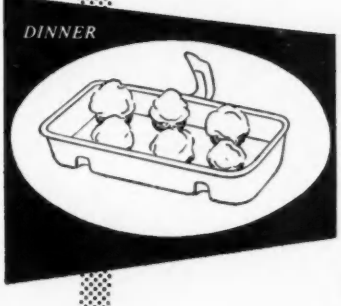
EGGS & BACON with a difference!

Remove the yolks from 4 halved hard-boiled eggs and replace with a mixture comprising diced bacon, egg yolks, seasoning, sauce and rice crispies.
Place halved eggs on rounds of toast in a greased fireproof dish and sprinkle with rice crispies and a little melted margarine on top. Place under pre-heated grill for 5-10 minutes.



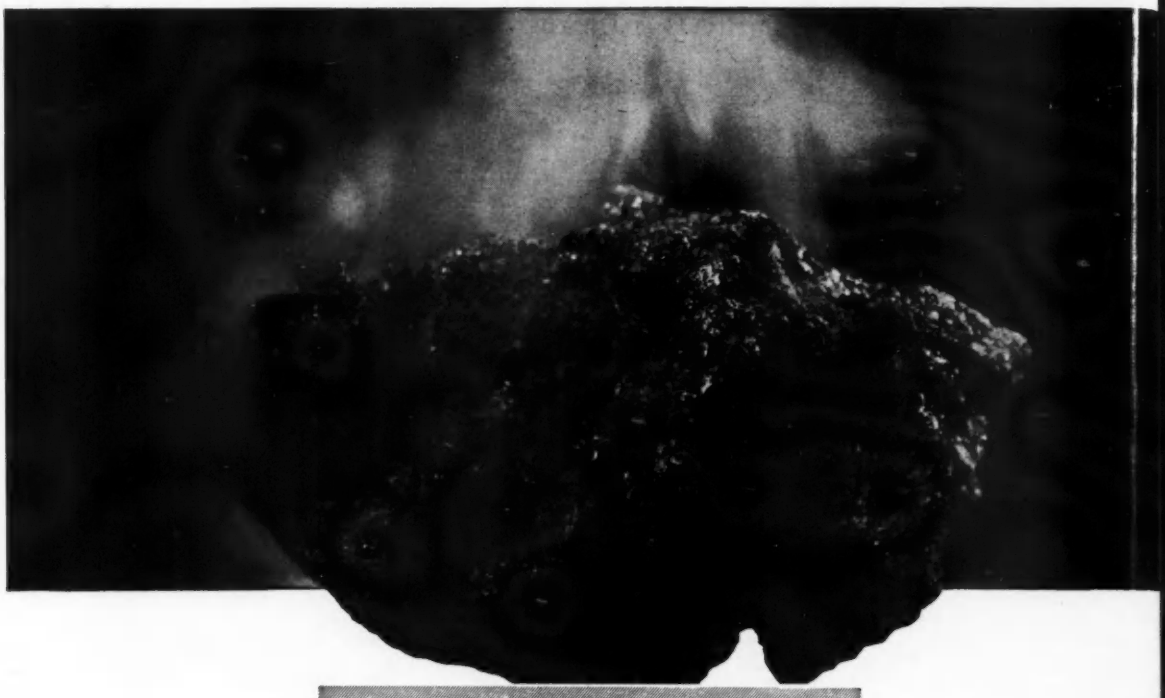
RUSSIAN KEBABS

For each Kebab, skewer half a blanched kidney, small piece of steak, roll of sliced bacon, halved tomato, small sausage, and a mushroom, and brush with melted fat. Place under pre-heated grill for 7-10 minutes on grid in pan with long supports downwards. Serve on a bed of boiled rice decorated with watercress.



ORANGE SNOWBALLS

Peel top halves of oranges and remove sections complete, leaving rest of the peel as a cup. Separate and skin the sections, reform them in the peel cups and place in grill pan. Coat top halves of the oranges with meringue mixture and sprinkle with sugar. Place under pre-heated grill until delicately tinged and serve in individual fruit dishes.



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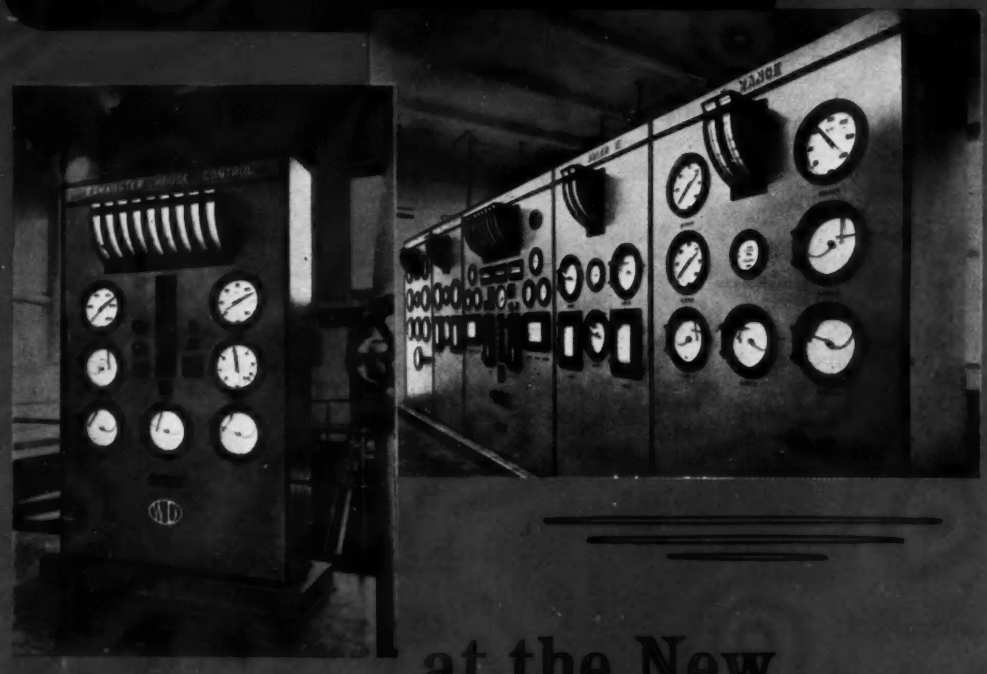

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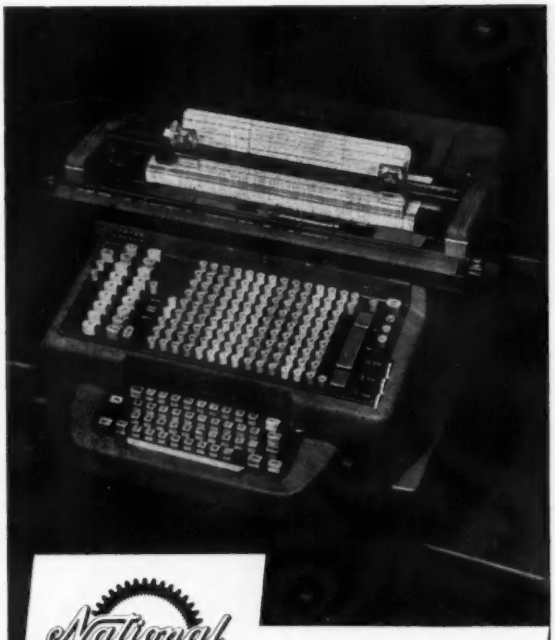

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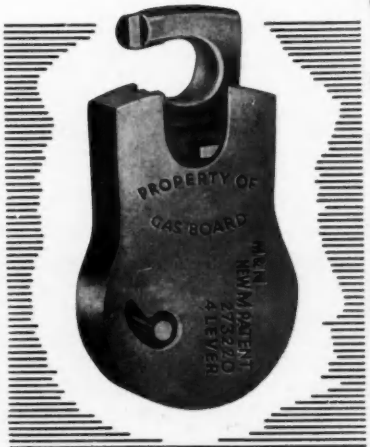

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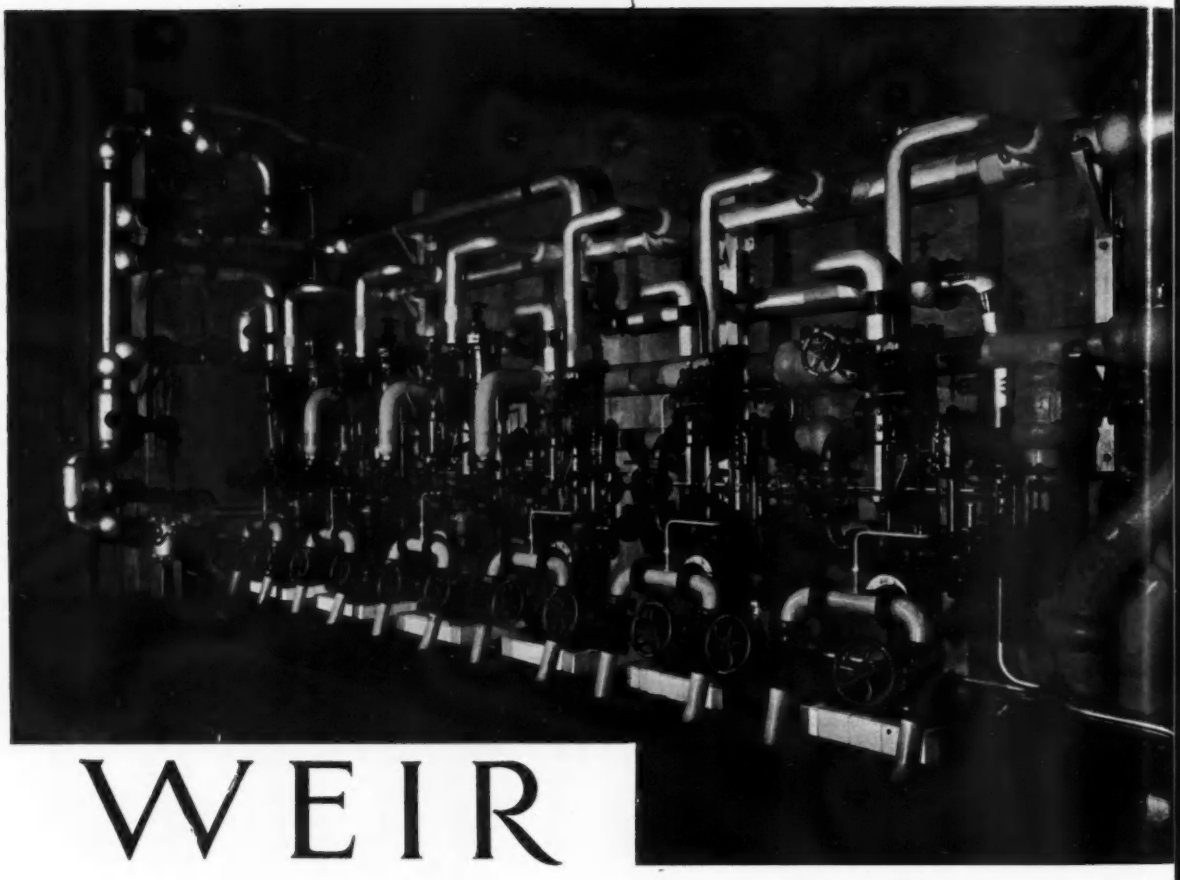

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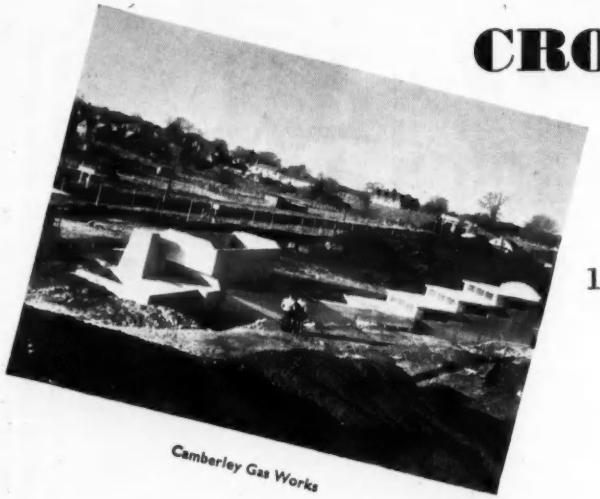

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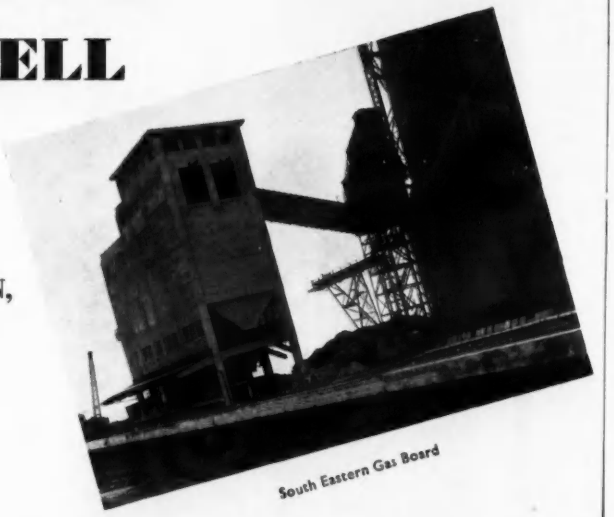

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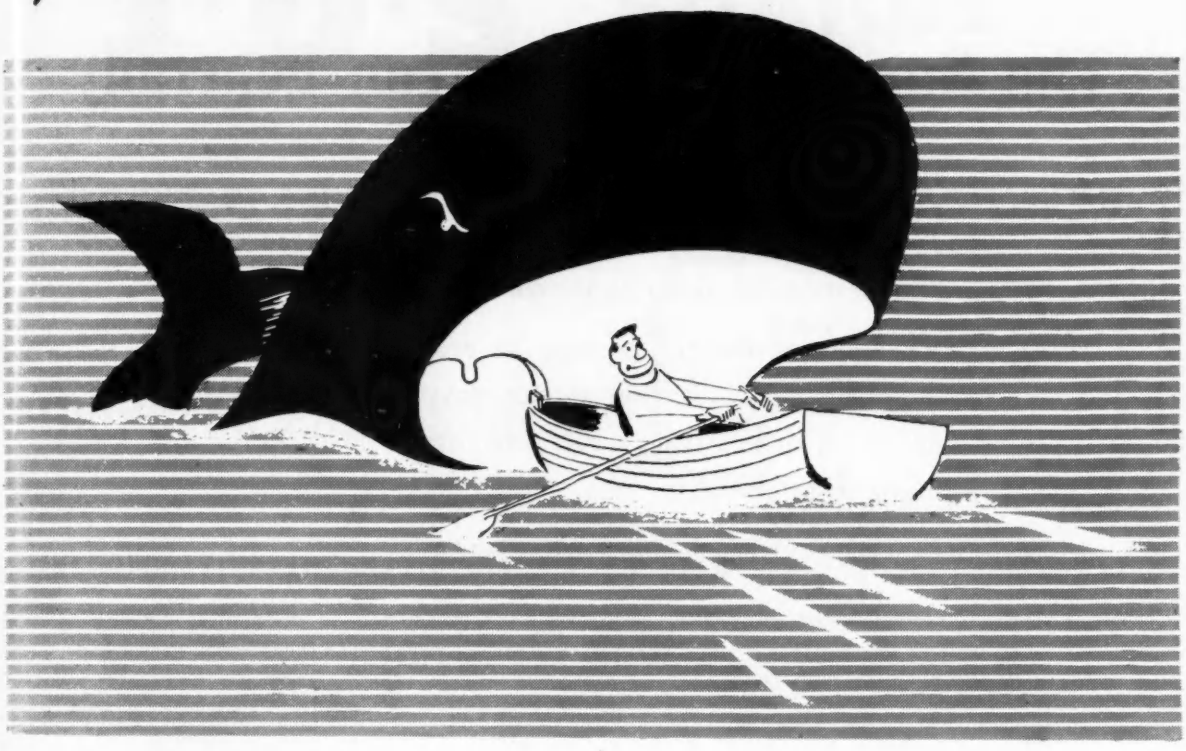

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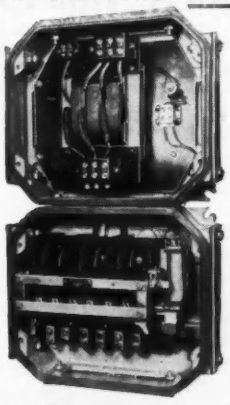

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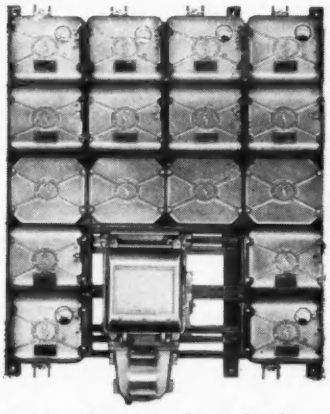

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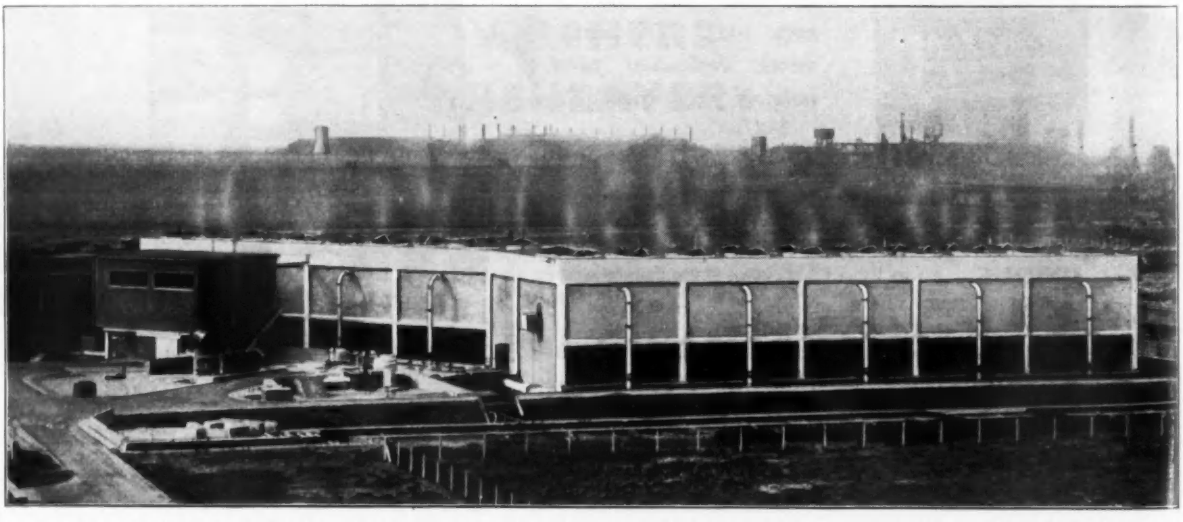

THE ABOVE ILLUSTRATION DEPICTS A WATER COOLING TOWER INSTALLATION OF THE MECHANICAL INDUCED DRAUGHT TYPE. TO ACHIEVE THE VERY EXACTING DUTY SPECIFIED A TOTAL OF 36 FANS ARE EMPLOYED WHICH ARE SITUATED IN THE ROOFS OF THE TOWERS. THE INTERNAL FILLING IS EXCEPTIONALLY COMPACT, CONTAINS THE LATEST IMPROVEMENTS AND IS SO DESIGNED TO MINIMISE OPERATIONAL COSTS. IN THE BACKGROUND TOWARDS THE LEFT CAN BE SEEN A 160 FEET HIGH NATURAL DRAUGHT HYPERBOLIC TOWER FOR A SERVICE REQUIRING A LESS STRINGENT PERFORMANCE.

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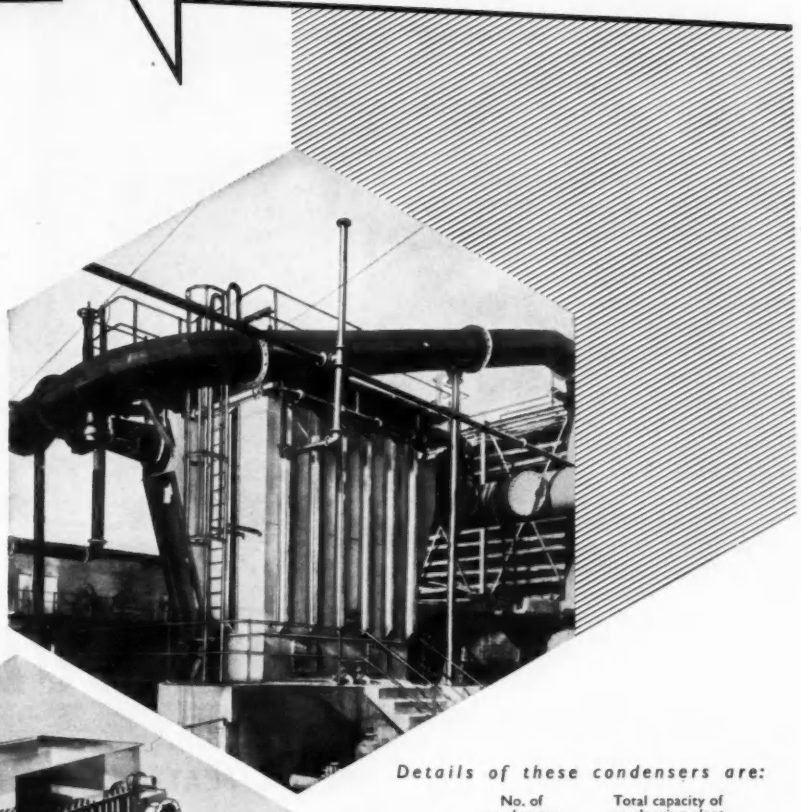

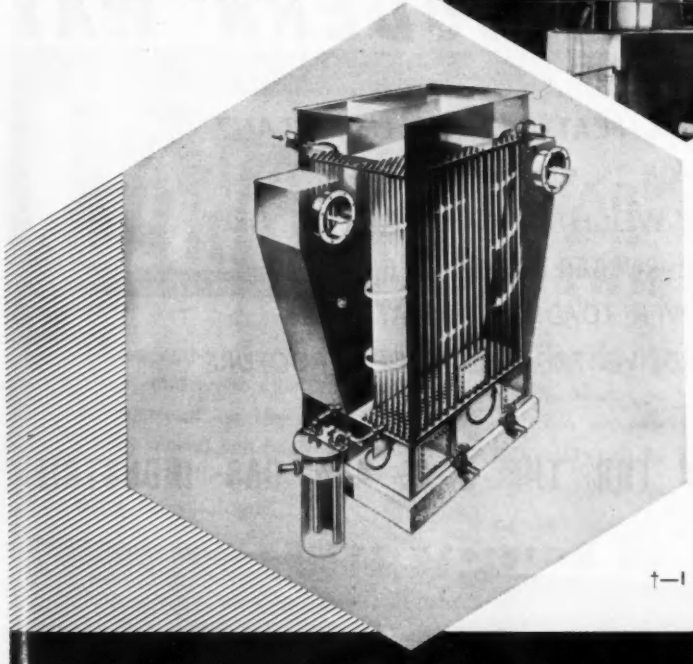

Details of these condensers are:

	No. of condensers	Total capacity of condensing plant
ABERAVON -	2 (s)	6½ mill. cu.ft. per day
BOLTON - -	2 (s)	8 mill. cu.ft. per day
CONSETT- -	2 (p)	16 mill. cu.ft. per day†
DEVONPORT	1	2½ mill. cu.ft. per day*
GILLINGHAM	2 (s)	3 mill. cu.ft. per day
LINACRE - -	2 (p)	8 mill. cu.ft. per day*
NEEPSEND -	2 (p)	10 mill. cu.ft. per day
PAISLEY - -	2 (p)	8 mill. cu.ft. per day*
REDDITCH -	2 (p)	3½ mill. cu.ft. per day*

s—series p—parallel *—operating
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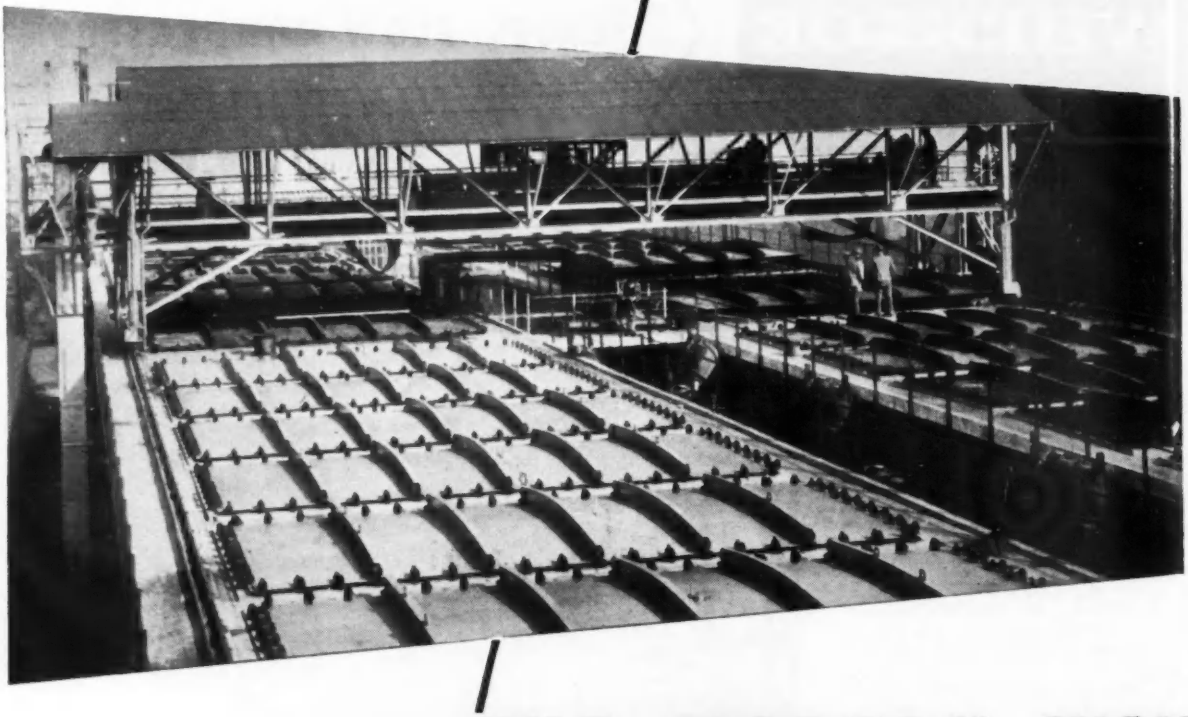

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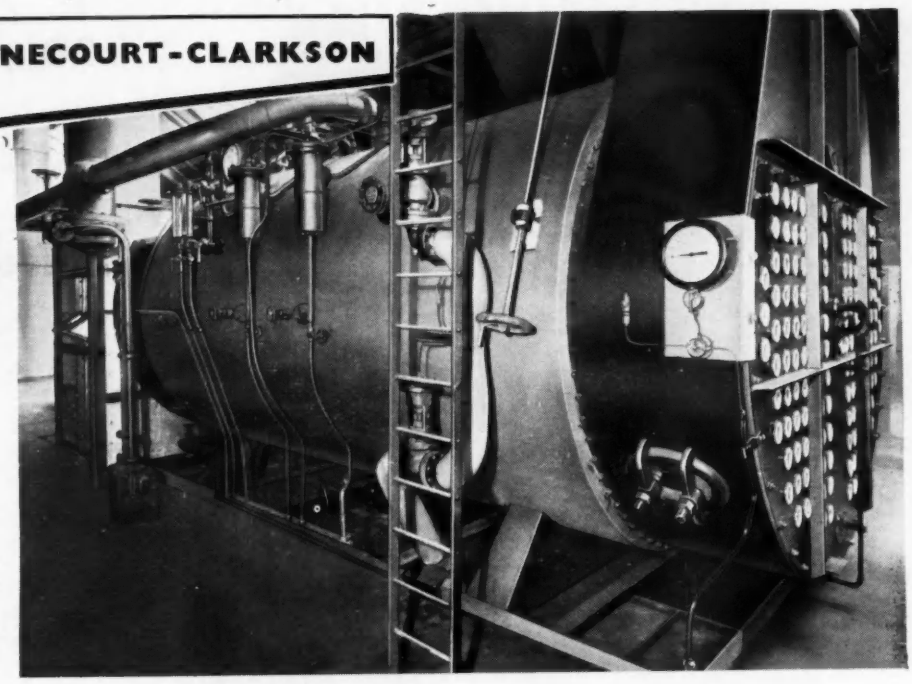

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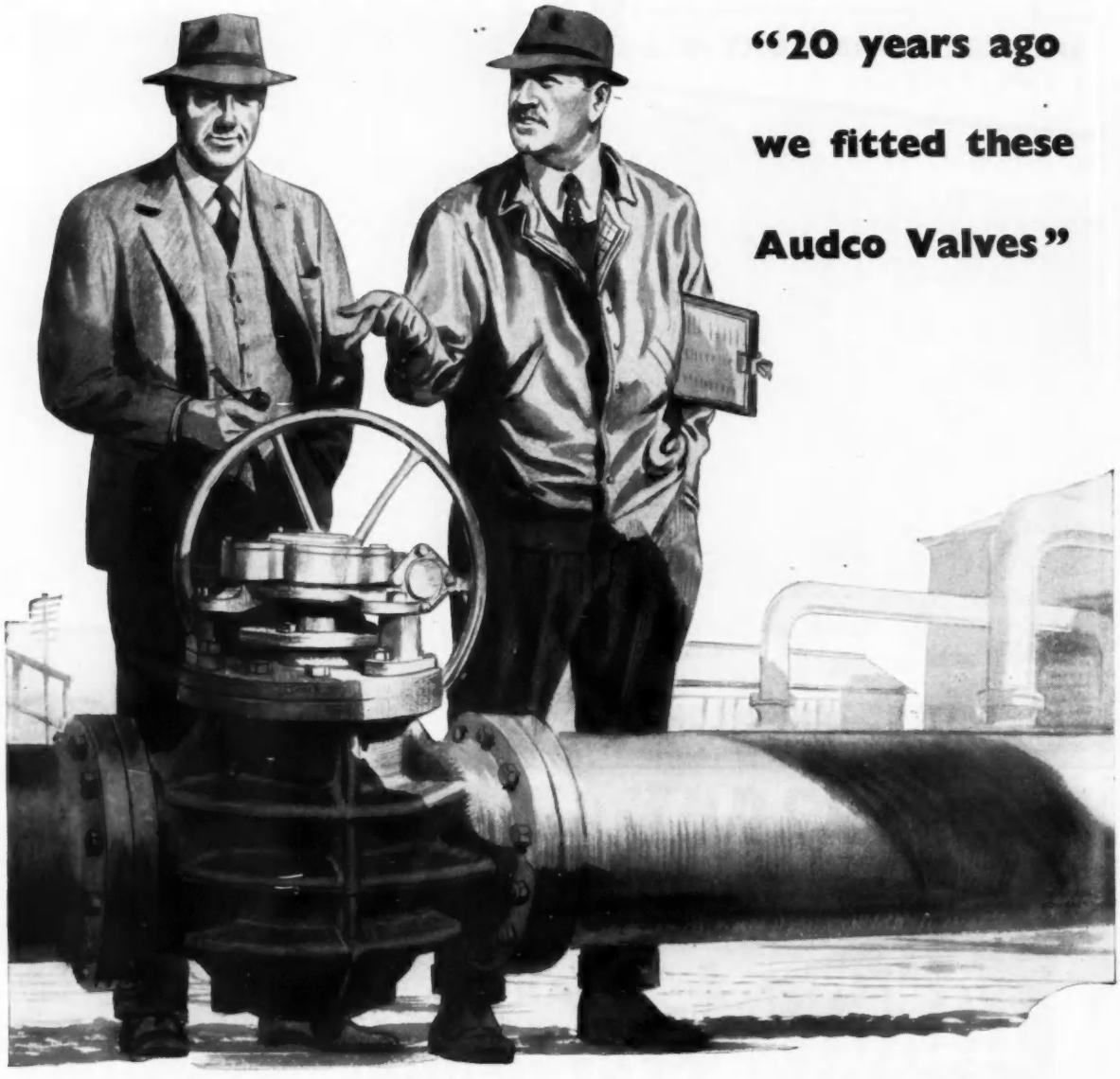

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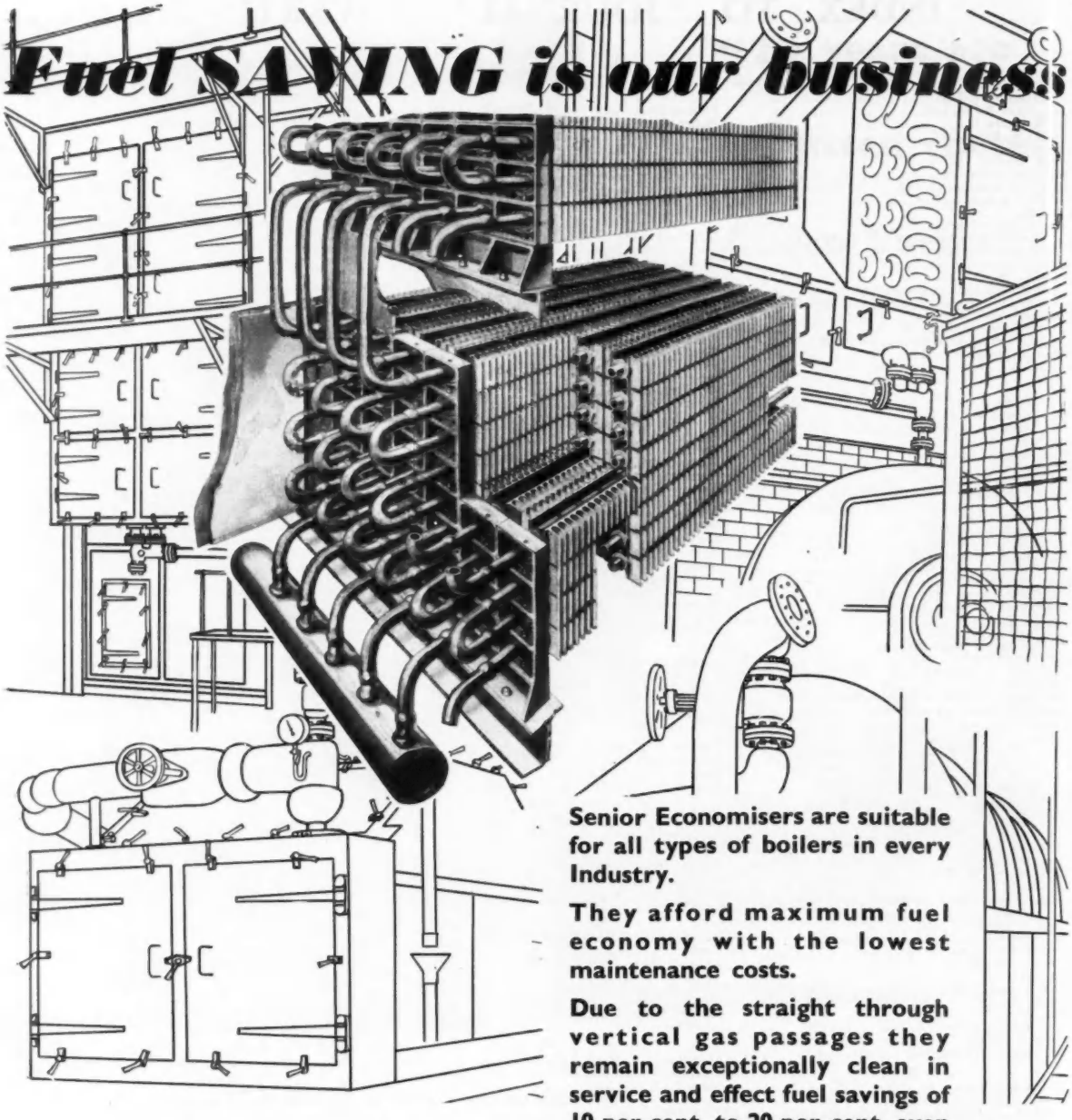

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Gas Journal

VOL. 282 NO. 4803 June 22, 1955

107TH YEAR

MANAGING DIRECTOR: Clifford A. King

EDITOR: Trevor G. Williams, A.M.I.Mech.E., Assoc.Inst.Gas E., M.Inst.F.

DEPUTY EDITOR: Arthur C. Cross

Published by Walter King Limited, 11, Bolt Court, Fleet St., London, E.C.4

Telephone: Central 2236-7. Telegrams: Gasking, Fleet.

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PUBLISHERS' NOTICE, SEE PAGE XV, JUNE 8, 1955, SUPPLEMENTARY ISSUE.

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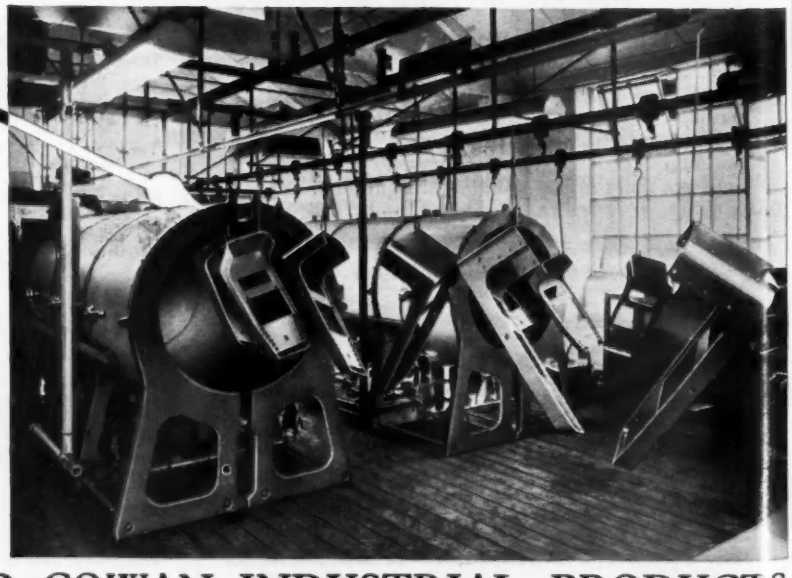

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Gas Journal

VOLUME 282. No. 4803. JUNE 22, 1955. 107th YEAR

Accelerated Carbonization

THE pith and marrow of the paper presented to the Institution of Gas Engineers by Mr. W. Hodkinson and his colleagues is contained in their admirably phrased conclusions. At Partington the results obtained in the preliminary work at Rochdale on accelerated continuous carbonization were fully confirmed—on a commercial scale. Using blue water gas as the carrier, output per retort when making gas at 450 B.Th.U. per cu.ft. from Yorkshire coals was double that when steaming down to this value; and that, when operated under such conditions of labour and technical supervision as are found in the gas industry. Hydrogen enrichment value was not reduced. Overall coke for sale was slightly reduced, but its properties 'are not significantly changed.' Difficulties with coal travel to the retort were overcome by the use of the trunk feed. Scurf formation is not noticeably different. The use of coal gas as the carrier resulted in the degradation of hydrocarbons and increase of scurf and would appear to offer no advantages over water gas *at this calorific value—i.e.*, 450 B.Th.U. per cu.ft.; and Dr. Burns has shown that it is not a practical proposition at 500 B.Th.U. per cu.ft. Operating at combustion chamber temperatures some 200-300°C. below standard, outputs equal to those obtained by steaming were realized. Slacks (washed smalls) could be carbonized at throughputs greater than with steaming.

Those are the technical results in a nutshell. We are left to work out the cost per therm of gas made in this way for any particular conditions. Such calculations as we have seen are not very encouraging, but no doubt there are cases where the process would be a paying proposition if only, as has been said before, to save capital expenditure on new plant. Mr. Hodkinson re-affirmed, in his reply to the discussion, that in the North West they talk in terms of substantially increased gas requirement and compare the Rochdale process on existing sites with building new works on new sites, the present day capital cost of which is quite prohibitive. There was, moreover, the interesting point that the flexibility of the process rendered it suitable to the development of the industrial load with its problems associated with the five-day week.

But the carbonization of blended coals at Bollington is a different matter. It is a weakness of the continuous vertical retort that when coals are broken down sufficiently to obtain a real blend, throughput is very materially reduced, in some cases to an impossible level. Can the Rochdale process help us here? The results at Bollington so far can only be regarded as inconclusive. Reverting to 'Conclusions'—'Carbonization of coal blends appears to be practicable when certain difficulties have been overcome.' The main difficulty seems to be that of getting the injected gas through the dense mass of fine coal. And the quality of the coke produced is disappointing. Its C.A.B. value was a little better than standard, its ignition requirement was about the same, and its combustion efficiency on the Fulham grate was low. But the more alarming feature was its apparent weakness. In one instance, we are told that 'this coke was stable, on storing, for a period of approximately two weeks.' What are the implications of this? And are we to understand that the work at Bollington will be continued? So far its value must be regarded as considerable, if only in a negative sense.

This paper gave rise to a fruitful discussion, a discussion which will go on. For one thing, as Mr. Gaskill put it, the paper 'outlines not a conclusion but rather a beginning of techniques which in their development will prove of value to the industry and to the nation.' Mr. J. E. Davis analyzed the fundamentals of the process. The advantage of a carrier gas which does not react chemically with the charge is no doubt the prime fundamental. Such a gas carries heat up the retort without the deduction due to the water-gas reaction which occurs in steaming. But is it true that steam, with the water gas generated *in situ*, 'displays no such ability'? Is it not true that not only did steaming increase make per ton, but did it not also increase throughput, in some cases by as much as 33%? It seems to us that it is due to the carrying ability of the mixture of unconverted steam and water gas that it is possible in steaming, not to maintain the volumetric output of gas 'almost unchanged' but to keep the thermal output of the retort constant or nearly so, without increasing the consumption of coke in the producer, though not of course without increasing fuel consumption per ton of coal carbonized. Mr. Davis' answer to the question, 'What then does the carrier gas system achieve?' is most significant. It achieves the replacement of enriching hydrocarbons from oil by enriching hydrocarbons from coal. And thus 'it avoids taking coke off the market at times when it is in most demand, namely, when gas output is highest.' Dr. Burns' contribution was mainly a repetition in

summary of the results of, and observations prompted by, the experience of his Board at Bow Common. He repeats his considered opinion that blue gas has been proved to be the most suitable carrier gas, but that unfortunately it cannot be used where gas is to be distributed at 500 B.Th.U. per cu.ft. In such circumstances coal gas must be used with the serious disappointment that the hydrocarbons are degraded; and 'the hydrocarbons are the most valuable product which we make.' Dr. Lessing made another point—that the carrier gas passes through the charge with a relatively high velocity so that there is 'a considerable amount of tarry material that should be subject to gentle decomposition in the gasmaking process which will go out of the retort before it has had time to undergo this treatment.' It has, we believe, been observed that tar production does indeed tend to increase with this process.

Dr. Burns puts the situation of coke in this process fairly and squarely. When you use water gas as the carrier, it is made not in the retort, but in an external generator 'where the efficiency is not so high—so that with the carrier gas process you have less coke per ton of coal.' There is the further point that in the outside generator you must use, at any rate in standard practice, large, top-priced coke whereas in the retort water gas is made from carbon spread evenly over the whole.

Remarking on the economics of the process, Mr. Davis said that the short paragraph under this heading in the paper reminded him of the folk song which ended 'If you want any more you can say it yoursen!' Mr. Pickering, after recounting his experience with the process in the Birmingham Central Test Works, proceeds to contribute three stanzas. His Board examined three cases, in all of which the carrier gas process was estimated to result in a dearer therm. Mr. Gaskill's company has investigated a larger number of cases, and he concludes that 'only in infrequent cases . . . can the carrier gas process be shown to be economic at its present stage of development.'

Mr. Hodkinson made a spirited verbal reply. We shall probably hear more from him when he has had time for further consideration of the many points raised in the discussion. He insists that the coke/coal ratio in the North West is such that his Board can afford to lose coke per ton in favour of increased throughput and increased productivity of capital and labour. He emphasizes the point that increased output from existing plant may outweigh the advantages to be derived from new works on new sites, 'the present-day capital cost of which is quite prohibitive.' But one must see that there is a limit to expansion by this means too. However that may be, all will agree with Dr. Burns in saying that we enjoyed this paper—and the lively debate which followed it

The Push Button Gasworks

ONE of the more enjoyable and interesting of our duties is attending, from time to time, inaugurations of new gasworks and extensions to plant. Last Friday it was our good fortune to be present at the inauguration by Sir John Stephenson, Chairman of the Eastern Gas Board, of the extensions to the Willoughby Lane works of the Tottenham Division of his Board, which extensions are described on pp. 829-834 of this issue. A number of particularly interesting features are incorporated in these extensions which comprise, in the main, new coal and coke handling plant, and carbonizing plant, together with the appropriate ancillaries. Under the expert guidance of Mr. F. T. Brookes General Manager, Mr. E. O. Rose, Engineer, and Mr. W. T. J. Gedge, Constructional Engineer, all of the Tottenham Division, the latest techniques in design, construction and operation have been employed to produce what has been referred to as a 'push button gasworks'. Certainly, automatic control plays a very important part, particularly in the operation of the coal and coke handling plant and, during our tour of the works, we were fascinated to note the ease with which one man could control, from a single point, the operation of a complicated system of belt conveyors and how, furthermore, the system is so interlocked that conveyors will only start up in their correct sequence. On the construction side, the wide use of pre-stressed concrete deserves a special mention as does also that of an 'umbrella' roof over the carbonizing plant. It will be remembered that the intermittent vertical retort bench at Ponders End works has such a roof and it is evident that the Eastern Board, at least in its Tottenham Division, regards this type of gasworks construction with great favour.

The housing for the retorts at Willoughby Lane consists not only of the roof proper but also a series of sloping louvres throughout the side of the structure, and, at a distance from the plant, the impression is given that the building has almost a completely sheeted side. An advantage of this arrangement is no doubt that, whereas in normal brick construction, the windows have either to be cleaned frequently or left wide open, at Willoughby Lane, light and fresh air can pass unimpeded across the settings. Whether such a roof and side wall construction would be as satisfactory in, say, the North, where temperatures are lower and the winds more biting, is another matter. Architectural considerations might also weigh more heavily in a residential area. One this is clear, however, and that is that this type of construction is much less costly than for a standard type of building, and, it may well be that, as was said at the inauguration, 'the thousands of consumers to be served by the new plant would not worry if there had been any sacrifice of beauty but that they would say "you can keep the beauty—we prefer the gas".'

Perhaps one of the most significant features of the new carbonizing plant is that it is designed to provide a first class solid fuel for the open fire. Although the Beaver Report had not been presented when the plans for these extensions were discussed, nevertheless the Eastern Gas Board had in mind from the first the necessity for producing a high grade smokeless fuel for the domestic grate. In many respects it has thus been able to anticipate the recommendations of the Beaver Committee. This is very good news for the nation and an outward and visible sign that 'the gas industry is very much alive and on its toes.' A further sign of the alertness of the Eastern Board to present-day trends in gas manufacture is that extensive arrangements have been made for blending and mixing coals at Willoughby Lane; the purpose of this is of course to provide greater flexibility in gas production, also a closer control over coke quality.

In all that it has done at Willoughby Lane works, it is obvious that the Board looked well into the future a

the design stage. In some cases, the period between the initial planning of new works and their completion is sufficient to outdate the plant in question, but in this case the view was so long-sighted that the extensions can be considered right up to date in every respect. Altogether the works at Willoughby Lane, as it at present exists, is one of which not only the Eastern Gas Board but also the whole gas industry may be proud.

'A Terrific Achievement'

CLAIMING it to be 'a terrific achievement,' Mr. C. H. Chester, Chairman of the South Western Gas Board, told the Gas Consultative Council at a special meeting at Taunton last Wednesday that within a few days the Board will have laid 1,000 miles of pipeline since vesting day. He was concluding an address—given with mixed feelings of pleasure and disappointment—in which he reviewed achievements in the past three years and imparted the unpleasant news of an inevitable rise in gas charges to narrow the gap between rising costs outside the Board's control and the results of greater efficiency within. Gas price increases have been fairly general in recent months, and consumers in the South West cannot really complain when they compare the extra 8d. per week payable by the average consumer with the greater rises in coal, electricity, rent, rates, and other costs of living. Indeed, Mr. Chester and his Board are to be complimented on having pegged the price of gas for three years since the last increase in June, 1952. That has been achieved in five ways—by improving technical efficiency, closing down uneconomic works, greater economy in operation, improving productivity, and increasing sales.

The new tariff revision involves an average increase of 2.95d. per therm; the reason it is not uniform throughout the area is that some attempt is to be made to restore differentials as between the larger towns and some of the more remote districts. Developments at Bristol, Swindon, and Yeovil have also made it necessary to revise some of the 'price areas.' The Board has made a very proper approach to the problem of the 'small' consumer, who is not necessarily the consumer in poor circumstances, who does not contribute his proper share of the costs of making a gas supply available for him to use, by introducing a standing charge of 3s. per quarter for ordinary consumers and 3s. 9d. per quarter for prepayment consumers, irrespective of the quantity of gas consumed, and abolishing the present separate charge for primary domestic meters. Another important change is the extension of the 'constant demand' tariff, so effective in attracting increased business in the last three years, to consumers of not less than 500 therms per quarter. Results for the sixth year under nationalisation are not yet available, but Mr. Chester hazarded the opinion that the figures would show 'just a small profit.'

The closing down during the past year of 20 works having a combined annual output of about 5 mill. therms (the largest being Trowbridge, Newton Abbot, Teignmouth, and Dursley) brings the total of works closed since vesting day to 39, and reflects some of the effects of the integration plan adopted shortly after the Board came into being. Mr. Chester told the Consultative Council that the policy of integrating small works around major centres of production had been pursued vigorously of late. Apart from the network of mains radiating from each manufacturing centre, each centre is itself connected to its neighbour in order that full advantage can be taken of the base-loading of selected works. This means that the gas grid will be continuous, when the Board has completed it, from Evesham in the north to Penzance in the south, and will probably be the largest gas grid in the country. The completion of the first 1,000 miles of new pipeline is therefore an important milestone.

SEARCH FOR NATURAL GAS

A SECOND deep well is to be sunk in the area near Crowborough, Sussex, as part of the Gas Council's five year search for natural gas. The site is about one mile south east of the first well and work there is likely to begin in the next few weeks and to continue for four or five months. The first well was carried down to a depth of about 4,500 ft., and revealed small shows of gas at several levels. The results obtained from that well and subsequent seismic surveys in the area have been studied by the technicians of the D'Arcy Exploration Company (a member of the B.P. group) which is undertaking the work on behalf of the Gas Council, and it is considered that a further deep test is justified.

WHO IS THIS GUY?

HILDING H. CARLSON, Editorial Director of *American Gas Journal*, was recently the recipient of a letter from this Journal's Editor, Trevor G. Williams, conveying good wishes to the American publication under its new owners—the Petroleum Engineer Publishing Company. 'As the only paper which is your senior in years, "GAS JOURNAL", with its 107 years of service to the British gas industry behind it, sends its heartiest salutations to you and looks forward with you to the celebration of your Centenary in four years' time,' concludes Mr. Williams' letter. This, together with a photograph, occupied half a column of the May issue of *American Gas Journal*. The rest of the column was nearly all taken up with Mr. Carlson's reply addressed to 'T.G.W.' Said Mr. Carlson: 'It was with no small sense of being honoured that we received your thoughtful expression. Indeed, we shall expand our efforts to inform American gas utilities during this period when the technologies of gas distribution and utilization are advancing at such a rapid rate. The two most recent Editors of *American Gas Journal* often have doffed their hats, in most respectful recognition of views expressed by their British cousins, in the "GAS JOURNAL". The problems of our two industries, the attempts at solutions and the results seem notably similar, at times. Most appropriate, in this first exchange of correspondence, is our expression of the best of good wishes for you, your staff and your book. And, in this instance at least, we shall represent our gas utilities with a cheery salute to the British utilities.—H.H.C.'

Not all the American gas industry appreciates our 'JOURNAL' and its Editorship so wholeheartedly, however. Next to the letter is a two-column novelty advertisement for tubing and linepipe. A man called 'Joe Roughneck' is looking out of the corner of his eye, apparently at Mr. Williams' picture and underneath is the large inscription—'Who is this guy?' We much prefer H.H.C.'s gracious and, incidentally, highly esteemed compliments!

An invitation is to be extended to the British Association for the Advancement of Science to hold its annual meeting in Glasgow in 1958. The last meeting of the Association there was in 1928.

Personal Notes

MR. J. A. CHARLES, A.M.I.MECH.E., who has been with Smith Meters, Ltd., since 1946, has been appointed Chief Development Engineer (Gas Meter Division). Mr. Charles is the son of the late Mr. A. Charles, M.B.E., who was a Director of the United Gas Industries and Smith Meters, Ltd.

MR. STANISLAW STEFANYSZYN, a Ukrainian employed at the Newtown (Montgomeryshire) gasworks for the past six years, set out on May 24 for Liverpool on the first stage of a journey to Vancouver to take up a forestry post. Fourteen days later he was back at Newtown, where Mr. H. Evans, the Gasworks Manager, looked after him until he sailed ultimately on June 17. He was one of 550 emigrants put ashore in consequence of the seamen's strike.

MR. EMMANUEL MADDOCK, Water Gas Foreman at Keyham, Devonport, for the past 15 years, who retires at the end of this month, at the age of 65, has worked at the Keyham station since 1906. On June 14, he was presented with a cheque from the South Western Gas Board by the Keyham Station Engineer, Mr. P. G. Richardson, and by Mr. J. Luce, with a cheque from the retirement and benevolent fund, of which he is chairman. Mr. Maddock also received a long service certificate.

MR. J. R. TOZER, B.E.M., M.M., Carbonizing Superintendent at Hollacombe, Paignton, retired on May 31. Mr. Tozer has been a well-known figure at Hollacombe works for many years, and the occasion was marked by the presentation to him of an easy chair, a reading lamp, and fishing reel by his colleagues in the industry. Apart from war service in the 1914-18 war, when he was awarded the Military Medal and attained the rank of Sergeant Major, Mr. Tozer has spent a lifetime in the industry. Joining the Stratford works of the West Ham Gas Company in 1907, he moved to Reading as Carbonizing Foreman in 1922, and three years later became General Foreman at the Hollacombe works of the Torquay and Paignton Gas Company.

MR. T. HARTLEY, MR. S. G. DEAVES, and DR. W. DALLAS SCOTT have been elected Directors of the British Tyre & Rubber Co., Ltd. Mr. Hartley joined the Company when it was formed in 1924 and prior to his appointment in 1951 as General Works Manager of the B.T.R. Group, he was, for many years, Works Superintendent at the Company's Leyland factory. Mr. Deaves also joined the Company on its formation and has been Sales Manager of the Industrial Rubber Products Division since December, 1951, prior to which he was for many years in charge of the Northern Sales Division. Dr. Scott joined the Company last November as Personal Assistant to the Managing Director, prior to which he was Director of Overseas Development of Monsanto Chemical Co., St. Louis, U.S.A., and a Director of Monsanto's English and Australian subsidiary companies.

MR. HARRY S. BROOM, M.I.MECH.E., Founder and Chairman of Broom & Wade, Ltd., compressed air engineers, High Wycombe, celebrates his 80th birthday on July 7. Born at Moulton, Norfolk, Mr. Broom was, at the age of 15, apprenticed to an engineering shop in Norwich at a wage of 5s. per week. He later obtained a post at the engineering works of Davey Paxman & Co., where he was to meet his future partner, Jethro Wade. When still only 20 he built a refrigerating plant which led him to the study of compressed air. While Wade was building their first workshop—a shed in a High Wycombe cornfield—Harry S. Broom and two apprentices took on any odd jobs in the vicinity to pay for it. Mr. Broom's drive and ingenuity obtained for him the agency for the Hyatt Roller Bearing Company, which later led to his joining the boards of Vauxhall Motors, Delco Remy & Hyatt, and Frigidaire. Today, the two-man business in a cornfield occupies 14 acres, employs a total of 1,400, has subsidiary companies and agents all over the world, and has an authorized capital of £1 mill. Mr. Broom, despite his 80 years, is at his desk every day. 'When I look back on the ups and downs of my career', Mr. Broom says, 'I think my greatest satisfaction was the introduction of our employees' profit sharing scheme in 1928.'

Obituary

MR. J. W. LEE, who was for a number of years in the gas industry in South Wales and prior to his retirement was for eight years Manager of Pinxton (Derbyshire) gasworks, has died at the age of 86 at the home of his daughter at Chesterfield.

MR. G. F. TWIGG, who from 1918 to 1936, when he retired, was Manager of Castleford (Yorkshire) gas undertaking, has died at Exmouth. From 1901 to 1914, Mr. Twigg was Chemist in the Derby undertaking and then went to St. Hellier as Assistant Manager for four years. During the last war he took an appointment with the Air Ministry in London. From 1945 to 1946 he was in charge of Dawlish gasworks during the absence of the manager.

MISS WOLSELEY-LEWIS, B.A., a Vice-President of the Women's Gas Federation, has died. Although ill-health had prevented her attendance at meetings in recent years, her interest in the work of the Federation had continued since 1935, when Sir David Milne-Watson persuaded her of the need for a women's organization such as the Federation. She was its chairman for 10 years.

Correspondence

CHEMICAL ENGINEERING GROUP

DEAR SIR,—In the report on p. 784 of the 'JOURNAL' of June 15 of my remarks at the annual dinner of the Chemical Engineering Group, there are two points I should like to amend. In referring to the 'Segas' catalytic process of gasification I mentioned that the vessel (not the oil) was heated at one stage by the combustion of carbon and oil and that steam and oil were passed through it at another stage. Later on when referring to the Beaver Report reference is made to gasifying the dirtier and non-caking coals and 'leaving no ash.' This should have read 'leaving no coke.'—Yours faithfully,

HENRY F. H. JONES.

1, Grosvenor Place, S.W.1.
June 16, 1955.

Stanlow Visit

Members of the Midland Junior Gas Association visited part of the Stanlow Refinery, near Ellesmere Port on June 9. 'Part' is written advisedly, for the total area of the refinery exceeds 188 acres. When it is realized that one plant alone cost £3½ mill., some idea of the capital involved in building such an installation is more readily understood. Prior to luncheon the party heard an informative talk on the plant by one of the Shell experts. Mr. H. J. Reynolds, President of the Association, was unfortunately ill and not able to attend, and in his absence Mr. S. Crathorn, Senior Vice-President, led the party and thanked the Shell Company for its hospitality and for giving them the opportunity of seeing this most impressive plant.

Diary

June 24.—SCOTTISH JUNIORS (WESTERN DISTRICT): Golf Outing: Fereneze Golf Course, Barrhead.

June 25. — MANCHESTER JUNIORS: Ladies' Day at Chester.

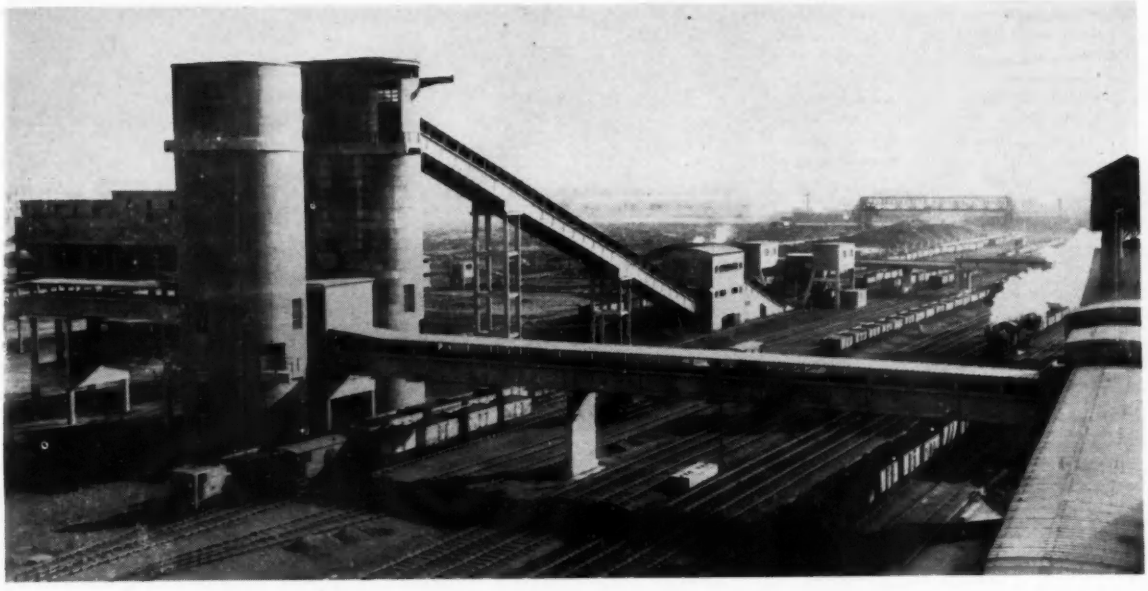
June 25.—LONDON JUNIORS: Ladies' Day. Morning visit: Watson House, lunch, coach to R.H.S. Gardens, Wisley, tea.

June 29.—SOUTH WESTERN SECTION I.G.E.: Summer Meeting and Ladies' Day, Taunton.

July 1.—MIDLAND SECTION, I.G.E.: Summer Meeting and Ladies' Day, Coventry.

July 5.—EAST MIDLANDS G.C.C.: Victoria Station Hotel, Nottingham, 11 a.m.

Mr. Geoffrey Lloyd, Minister of Fuel and Power, stated in Parliament on Monday in reply to questions about the effect of the railway strike on coal production that total distributed and undistributed stocks at June 4 were 13.3 mill. tons against 15.2 mill. tons on the same date last year.



Willoughby Lane Gasworks

A description is given of the extensions to this works of the Tottenham Division of the Eastern Gas Board which were inaugurated on June 17 by Sir John Stephenson, C.B.E., Chairman of the Eastern Gas Board.

THE first gasworks at Willoughby Lane was built in the year 1845 and the plant was situated near the present entrance to the works. The area of the original site was only 1.36 acres, but additional land was acquired from time to time until the works extended over an area of 15.89 acres, all lying to the west of the Great Eastern Railway Company's main line to Cambridge. In the early years of this century, however, the Directors of the former Tottenham and Edmonton Gas Company had the foresight to purchase considerable 'marsh lands' to the east of the railway, and further lands on the south-west which now form the Board's sports field. The whole site now amounts to 98.4 acres, but it should be noted that it is divided into four sections by the north to south line of the railway, and by a public footway running from east to west.

Before the completion of the present extensions the plant available consisted of:—

(1) Intermittent vertical chambers (installed 1933 and extended in 1939). Capacity 5.7 mill. cu.ft. per diem at 540 B.Th.U. per cu.ft.

(2) Continuous vertical retorts (installed 1916). Capacity 5.6 mill. cu.ft. per diem at 470 B.Th.U. per cu.ft.

(3) Carburetted water gas plant (installed 1945 to 1952). Capacity 8.8 mill. cu.ft. per diem at 500 B.Th.U. per cu.ft.

The decision to carry out the present extension was made by the former Tottenham and District Gas Company shortly before vesting date. The continuous vertical retort house, built in 1916 with mechanical producers and rebuilt in 1928 with 'built-in' producers, had given excellent service, but the mechanical handling plant was in such a condition that extensive renewals were due. It was also realized that by modern standards the working conditions were most restricted, and it was decided that in preference to rebuilding the plant in its existing house, it should be entirely replaced by a larger installation capable of producing eight mill. cu.ft. of gas per diem at 500 B.Th.U. per cu.ft. In addition to the new carbonizing plant, a producer gas dilution plant of two mill. cu.ft. per diem capacity will be erected during 1955. This, with the aid of increased calorific values in the C.W.G. plant, will enable additional gas to be manufactured at times of peak demand. The benzole extraction plant, which is due for extension, is capable of effecting a maximum reduction in the calorific value of the gas of only 13 B.Th.U. per cu.ft. The declared calorific value is 490 B.Th.U. per cu.ft.

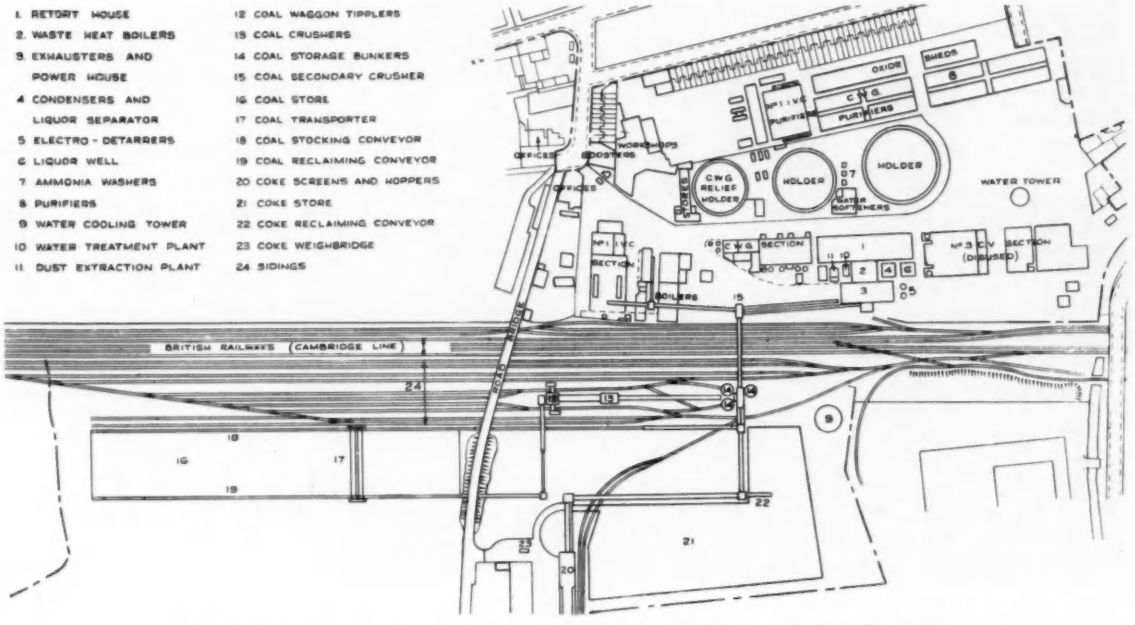
Coal Supply and Handling Plant

Durham coals, seaborne to Albert Dock and thence transported by rail to Tottenham, were largely carbonized in the intermittent vertical chambers, and Yorkshire and East Midlands coals, entirely railborne, were carbonized in the continuous vertical plant.

The ease with which coal deliveries were regulated prior to 1939 had rendered unnecessary the construction of any elaborate coal stocking plant. Coal had been stocked mainly as a safeguard against stoppages, and was stacked in heaps and reclaimed only when necessary, by means of steam locomotive cranes. Experiences during the war, and the introduction of seasonal stocking, showed that the system called for the employment of too many men and was excessively expensive when put into regular use. It was decided, therefore, that the extensions should include a new and complete system for coal and coke handling and stocking.

The limitations of the site in the north-western sector were such that there was inadequate space both to extend gasmaking plant, and to install new handling and storage plant. In preference to starting a completely new and self-contained gasmaking section to the east of the railway, it was decided to concentrate all manufacturing plant on the already developed site, and move all handling and storage plant to the east of the railway, linking these to the manufacturing plant by a conveyor gantry over the British Railways property.

The new coal handling plant is designed to deal with the existing intermittent vertical chambers, the new continuous vertical retorts and a further extension of vertical retorts of



Plan of works showing new No. 2 C.V. installation and coal and coke handling plant.

equal capacity. The coal carbonized by these three plants would amount to a maximum of 1,500 tons per diem.

Siding accommodation is provided to hold a total of 440 wagons, full and empty, and there are double-ended reception roads permitting trains of up to 80 wagons, hauled by British Railways locomotives, to be run in direct from the railway system. The layout of the sidings necessitated the extension of the Board's existing road bridge which spans the railway. This work was carried out in reinforced concrete.

The unloading plant has been designed to deal with all the coal required for carbonizing, together with an equal quantity for stocking, during the normal working hours of a five-day week. This is achieved by employing two combined wagon tipplers and weighers, each of which can handle 20 wagons per hour. Wagons pushed from the tippler run to the 'empties' sidings by gravity.

Coal is elevated to the main crushers by belt conveyors and raised by further belts for discharge into storage silos. Each of the two parallel elevating systems handles a maximum of 240 tons per hour. There are three storage silos, each of 600 tons capacity, and there is provision for a fourth.

The purpose of these silos is:—

(1) to store coal for blending;
(2) to act as buffers between the high-speed unloading of wagons carried out during daylight hours, and the slower passage of coal to the carbonizing plant or to store. The transfer of coal from the silos to the retort houses or to store is at the rate of 100 tons per hour.
(3) to provide storage to avoid week-end and Bank Holiday working and to facilitate the immediate clearance of coal trains as they arrive. Demurrage charges are thereby reduced to a minimum.

The three silos contain:—

(1) Clean Yorkshire or East Midland coals for the continuous vertical retorts;
(2) Durham coals for the intermittent vertical chambers; and
(3) low swelling coals and coals of high shale content, to be blended with Durhams, for carbonizing in the intermittent vertical chambers.

Blending is effected by feeding on to belt conveyors through adjustable vibrating feeders. All coal blended for the I.V.C. house passes on its way to the plant through a flexible tooth crusher to reduce it to a ¼ in. size. Coal is taken to the retort houses by inclined band conveyors and distributed to the overhead hoppers by push plate conveyors. Belt weighers are provided on the conveyors feeding coal to each retort house. The storage capacity in the retort house bunkers amounts to two days' supply in the case of the I.V.C. plant and three days in the case of the C.V. plant.

The coal stocking ground measures 920 ft. by 157 ft. 6 in. and can hold 52,000 tons of coal stacked to a depth of 18 ft. It is spanned by a travelling Goliath crane having a 2½-ton capacity grab which operates on transverse movement at a rate of 100 tons per hour. Coal can be delivered from any of the silos at a rate of 100 tons per hour and passed to the stocking ground by a band conveyor. The coal is discharged from the conveyor into a sunken bay adjacent to it and running the full length of the western side of the coal heap. The coal is subsequently moved transversely into the heap by the transporter at a convenient time. Coal raised from stock is loaded by the transporter on to a belt on the eastern side of the stocking ground and may be returned to the silos.

Coke Handling Plant

The works is planned to produce the maximum quantity of high-grade continuous vertical retort coke for sale on the domestic market. To achieve this, two special provisions have been made:—

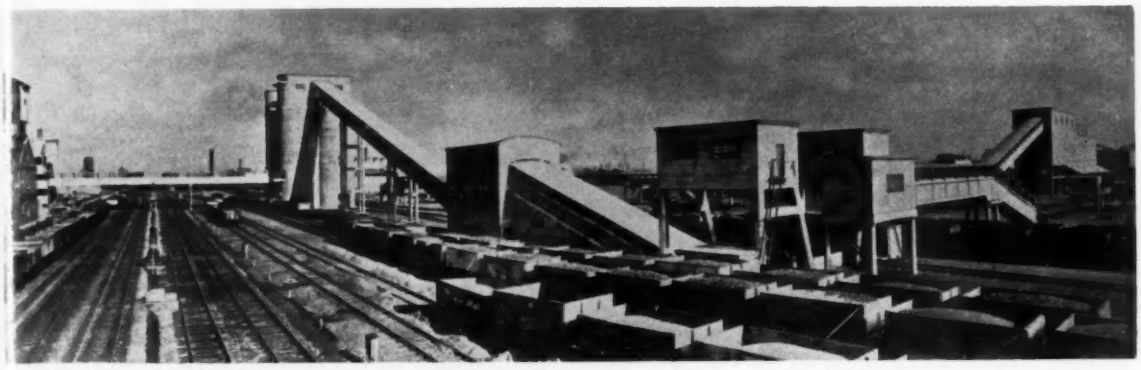
(1) the continuous vertical retort producers are fed with I.V.C. coke; and
(2) undesirable Yorkshire and East Midland coals can be disposed of as already described, by blending, in the I.V.C. plant.

In the continuous vertical plant, duplicated band conveyors, running beneath the retort extractor boxes, convey the discharged coke from the north and south benches to a central position. Here, two further duplicated conveyors, running in a sub-way beneath the boiler house and power house, convey the coke to the base of a transfer tower whence it is conveyed to the screening plant. The duplication ensures continuity in the handling of discharged coke in the event of a breakdown of, or repairs to any one of the conveyors. The operating rate is 35 tons per hour.

The coke screening plant consists of duplicated vibrating screens, grading into the three recognized sizes and breeze. There are nine coke hoppers, four for each of the two sets of screens, as follows: No. 1, No. 2, No. 3 and breeze, and a single hopper for unscreened coke of sufficient capacity to take 12 hours make of coke. The hopper capacities are as follows:—

No. 1 coke	each hopper 70 tons
No. 2 coke	each hopper 75 tons
No. 3 coke	each hopper 40 tons
Breeze	each hopper 95 tons
Unscreened	single hopper 170 tons

The total capacity of all the coke hoppers is 730 tons.



General view of the coal handling plant; coke screening plant on extreme right.

To maintain the balance of the various grades against irregular sales, it is possible to run out the coke from any hopper except the breeze hoppers, pass it through a cutter, and recycle it to the screening plant. In this way the breakage due to cutting is reduced to a minimum. The coke hoppers are provided with loading facilities as follows:—

(1) Debreezing screens and weighing machines for sack filling, and

(2) Debreezing screens for bulk delivery to rail or road wagons.

Coke from the continuous vertical retort house may alternatively be put to stock by means of a chain of electrically interlinked portable conveyors fed from a discharge point on the conveyor leading to the screens. The same portable conveyor installation is used to reclaim coke from stock by feeding into a recovery point on the conveyor system. The coke stocking ground has a capacity of 26,000 tons.

Coke is stocked ungraded, but as each set of screens is capable of dealing with the whole output, the quantity available for sale can be doubled at times of peak demand by bringing both sets of screens into action.

The coke from the intermittent vertical chambers is screened in the existing screening plant into appropriate sizes and is distributed by belt conveyors as follows:—

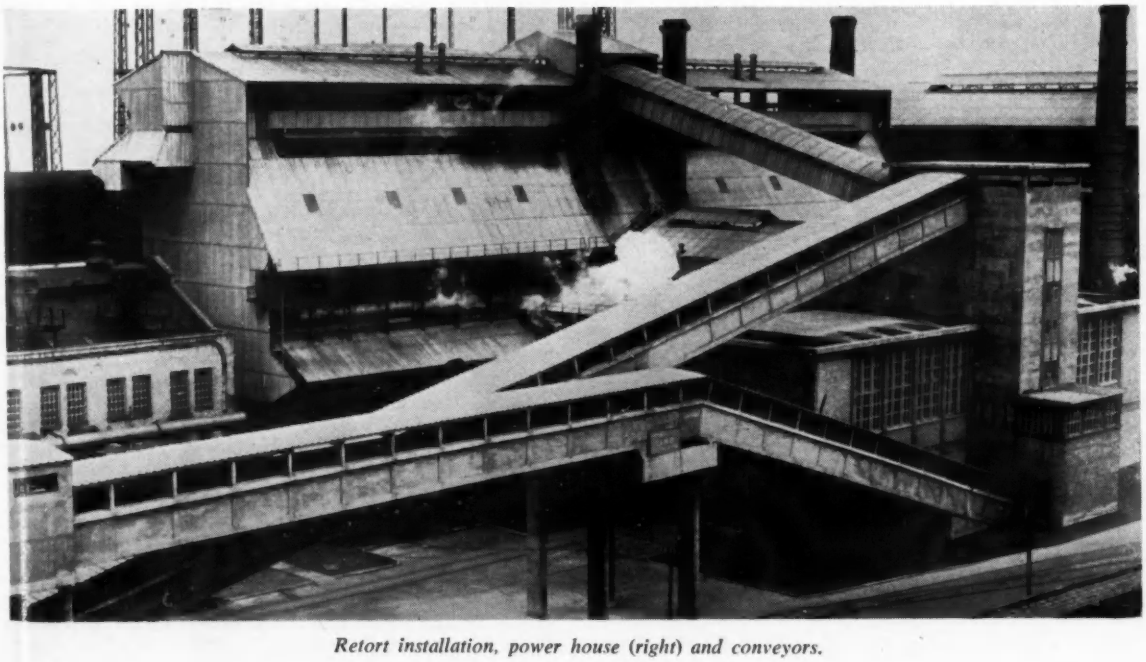
(1) To the I.V.C. producers; (2) to the I.V.C. breeze pads; (3) to the C.V. producers; and (4) to the C.W.G. plant.

Any coke remaining, can be sold from the hoppers. In the case of both (3) and (4) the coke enters the C.V. house above storage hopper level, and is distributed to the north and south producer hoppers by a reversible belt conveyor. This same conveyor is used for delivering coke to the C.W.G. plant, which is situated in a building adjacent to and in line with the C.V. settings. Belt weighers are provided on each of the conveyors taking coke from the C.V. house and on the conveyor taking coke to the C.W.G. plant.

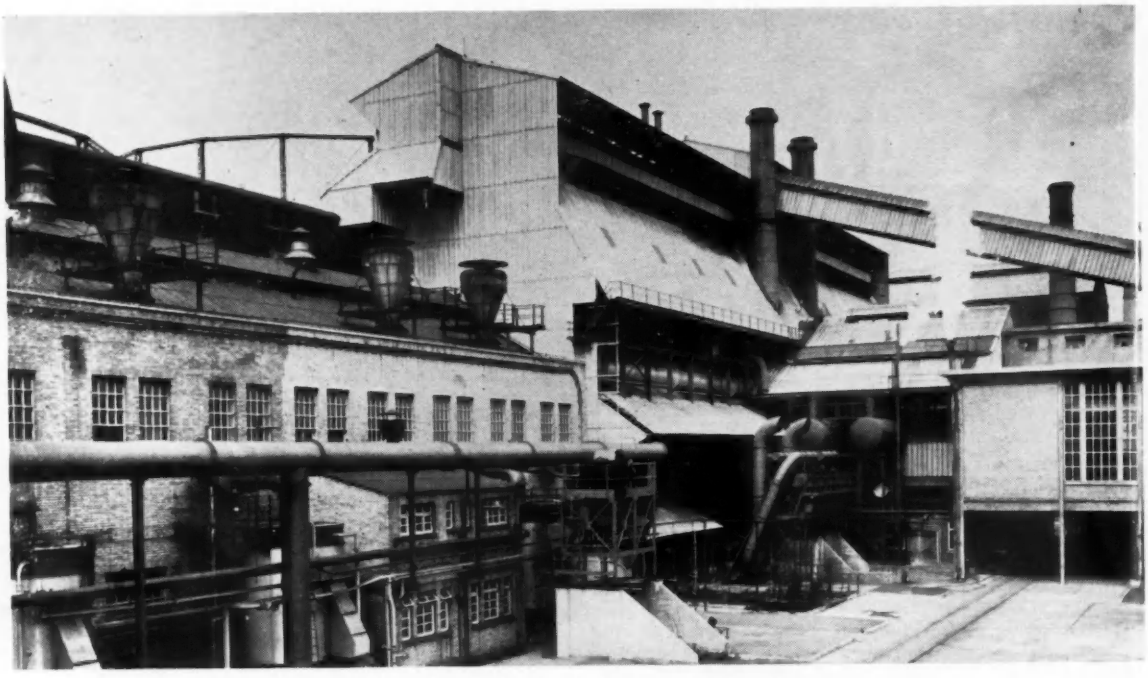
Conveyor Gantries

It was originally intended that the conveyor gantries should be steel framed, supported on reinforced concrete trestles and towers. The allocations of steel, made during the period of steel shortage, were only sufficient to allow for a delayed construction of the retort house, and thus, following a consideration of alternative materials, it was decided to build the gantries in prestressed concrete. This, in addition to reducing the steel requirements by 500 tons, has resulted in a durable type of construction needing little maintenance. The capital cost is about 15% more than the estimated cost of the steel-framed design, but this is offset by lower maintenance costs.

Each gantry consists of two prestressed girders of 6 ft. 6 in. depth, with reinforced concrete floor decking and roof framing to form a box section. The girders were cast *in situ* and post-tensioned by the Magnel Blaton system. The majority of the



Retort installation, power house (right) and conveyors.



Retort installation and waste-heat boiler house.

spans are 90 ft. long. Each gantry is supported by sliding bearings at one end, and with fixed supports at the other end. The gantry over the British Railways property is continuous in spans of 72 ft. and 108 ft.

Control of Handling Plant

The electrical plant of the coal and coke conveyors is divided into the following sections, each of which comprizes three or more electrically interlocked flow sequences:—

(1) coal from wagon tipplers and stock to the storage silos;
(2) coal from the storage silos to the retort houses and to stock;
(3) coke from the C.V. retorts to the coke grading plant and to stock; and
(4) coke from the I.V.C. coke plant to the retort houses and C.W.G. plant.

The conveyors carrying coke from the I.V.C. coke plant to the continuous vertical retorts and to the C.W.G. plant are fully automatic in operation, the flow being controlled by bunker level electrodes. Further, the size of coke is selected by push button control at the coke plant, according to the particular bunker to which it is being despatched.

Retort charging floor showing coal boxes.

The control gear for each of the four sections is grouped in positions most convenient for the operator concerned, and with the exception of Section (1), mimic diagrams are provided to indicate the sequence in operation. Direct on line starting has been adopted for all conveyor drives, the motor horse-powers ranging from 5 to 45 B.H.P. Electronic metal detectors, of a very low A.C. power consumption, are installed on the belts from the wagon tipplers to the coal crushers.

Carbonizing Plant

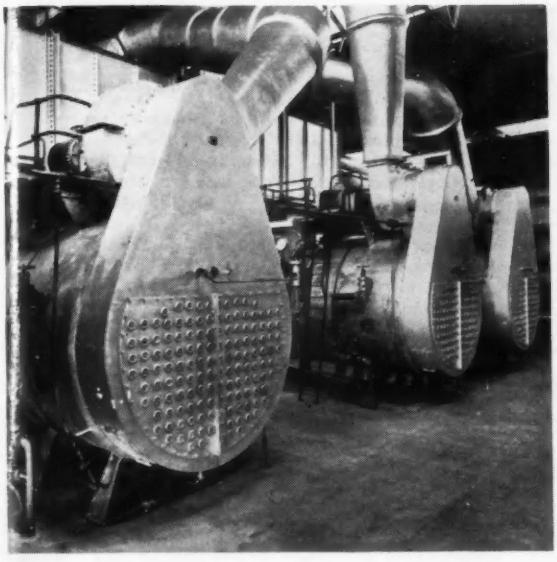
There are 64 82-in. continuous vertical retorts, arranged in four benches each of four sections of four retorts, the benches being in one straight line. Gaps are left between the four benches, but the space between the second and third benches is larger, and since coal, coke and waste gases enter or leave at this centre section, the settings may be considered to consist of a northern and a southern half. Heating is by means of the 'lambent heating' system, there being 12 external step grate producers arranged in four groups of three. The two groups in the north and the two in the south feed into common north and south producer gas mains. I.V.C. coke is fed to the producers through automatic weighers.

A dust collecting system is installed with hoods adjacent to the opening of each extractor box to deal with dust released during coke discharging. The valves between the hoods and the collecting duct of the system which runs between the extractor boxes are automatically operated by cams on the coke discharge car. The dust is extracted from the system in water filters and discharged as a sludge. Two steel, fire-brick lined, waste gas flues run from the north and south pairs of benches to the centre of the settings. Here, the waste gases may pass to their respective north or south chimneys, or to the waste-heat boilers.

Willoughby Lane works is not situated in a residential area, and as, in any case, there is no architectural merit in disguising an industrial plant of this nature, the orthodox retort house building has been dispensed with. No walls are provided, and protection from the weather is afforded by a series of 'umbrella' roofs. This method of construction showed substantial saving in capital cost and has given improved working conditions on the settings.

Tar and Liquor System

The tar and liquor system has been designed to relieve so far as is economically possible, the difficulties of the disposal



Waste-heat boilers: two in use, one standby.

of effluent from the Board's chemical works after the manufacture of sulphate of ammonia. Modern knowledge has been applied by the use of heavy spraying, rapid separation of tar and liquor and segregation of retort house liquor, although the use of hot gas detarrers has not been considered justifiable.

The normal retort house separators are used with the addition of measuring compartments which regulate the quantity of retort house liquor bled off with the tar run off. This liquor is led to a separate compartment in the main separator and is at present used, after cooling, in the final gas bays of the static washers. This avoids the use of water at most times of the year and enables a stronger final mixed liquor to be produced. The ultimate aim is to dispose of this retort house liquor separately when a suitable process is devised for its treatment.

The main separator is a reinforced concrete tank 12 ft. in depth and partially below ground level. It consists of three compartments, one for the retort house liquor, a central compartment for tar, and a third for condenser liquor. The tar and liquor pumps, all of which are electrically driven, are mounted on top of the tank, while the condensers are mounted on a reinforced concrete platform above the pumps.

The overflow from the condenser liquor side of the main separator is passed to a 70,000 gal. weak liquor tank, where final separation of small quantities of tar takes place. The liquor is then strengthened by being used as the washing medium in the earlier gas bays of the static washers. The strong liquors from the washers flow to the main works storage.

Waste-heat Boilers

The waste-heat boilers are not housed in an orthodox building, but as with the retort settings, are provided with an umbrella roof, giving considerable air circulation and cooler working conditions. Three boilers are installed, one operating for each half of the settings, and the third is a common standby. The boilers are 8 ft. in diameter, contain 550 tubes, and have a length of 16 ft. between tube plates. The boilers generate steam at 275 lb. per sq. in. superheated by 200°F. Each boiler is provided with an electrically-driven induced draught fan, the outlets from these fans feeding into a common main, from which two branches lead to the two chimneys. Superheaters are installed in the boiler inlet flues.

The feed water for these boilers is obtained from the existing base exchange softener. It is acidified to release the carbon dioxide which is then removed in an air blown tower. The water is finally deaerated before passing to the boilers. The boiler feed pumps are operated by steam at 120 lb. per sq.in. from the main works supply. The exhaust steam from these pumps is used for feed water heating. The steam supply from the waste-heat boilers is entirely absorbed in the generation of electric power. The generator engines exhaust at 30 lb. per sq. in. and the exhaust steam is used on the settings.

Electric Power

Prior to the inception of the new plant, power requirements were met by an internally-generated D.C. supply, except that A.C., from the public supply mains, was used for the C.W.G. plant, the chemical works and for deep well pumps. With the exception of plant unsuitable for conversion, the whole works now operates on A.C. The maximum requirements are about 700 kW.

Two out of the three 300 kW continuously rated engine-driven alternators are running at a time, and together absorb the total output of 18,800 lb. of steam per hour from the waste-heat boilers. The engines driving these generators are fitted with specially designed governor gear, which maintains the maximum engine output consistent with the steam available. Electric power is generated at 415 V, three-phase, and is distributed from the power house to the greater part of the works

Interior of power house showing spacious layout.

at this voltage. For transmission to the coal unloading plant it is stepped up to 11,000 V and transformed down again on the east side of the railway. The 11,000 V system is linked with the public supply mains and any balance of power requirement is made up from this source. The generators are thus operating in parallel with the public supply.

The main low tension control board is of the draw-out truck-type air break switchgear. Eight radial feeders from this board are divided into two sections, one serving essential and the other non-essential plants. A reverse power relay on the incoming transformer equipment ensures that, in the event of a public supply failure, the incoming switch is opened and the non-essential feeders are disconnected from the bus bars. Overloading the alternator is thus prevented. Capacitors are provided to raise automatically the power factor of the works load to an economical level. Mercury arc rectifier equipment of 100 kW capacity is installed to provide D.C. power to the I.V.C. plant.

Purification

Condensers

The three vertical water tube condensers, each of 4.2 mill. cu.ft. a day capacity, have common inlet and outlet mains, with suitable valves for individual operation, and are normally operated in parallel. Each condenser is divided into a primary and secondary section, with circulated water on the primary section and water from the works own well on the secondary section. The well water is subsequently used for circulating water make up. In order to provide a gravity return for the circulating water from the condensers to the cooling tower, which is situated on the other side of the railway line, the condensers are mounted on an elevated platform. The tar and liquor separator is housed in the base of this structure.

Exhausters

Two Connersville exhausters, driven by vertical twin cylinder engines, are installed, with provision for a third set. Each exhauster has a capacity of 9.6 mill. cu.ft. a day.

Detarrers

The two electrostatic detarrers are each of 9 mill. cu.ft. a day capacity, either one being capable of dealing with the total output.

Washers

Three four-chamber, static washers of the 'Multifilm' type, each of 9 mill. cu.ft. a day capacity, are installed, and operated in series. Any two of the washers when working together in series are sufficient to give adequate washing.

Oxide Purifiers

The purifiers are elevated boxes of reinforced concrete construction, and consist of four sections of five boxes arranged in two lines; there are no catch boxes. Each box is 30 ft. square, 7 ft. deep, and contains two 2 ft. 3 in. layers of oxide. An overhead transporter spans the two lines of boxes, and has a 25 tons per hour conveyor for filling the boxes. The transporter is also used for lifting and removing the box lids. The oxide elevator at one end of the transporter has been designed with an aluminium-alloy casing, to obviate corrosion.

General view of box purifiers.

A covered oxide store, constructed of pre-cast concrete pin-jointed members, is erected alongside the line of the purifiers. New C.W.G. purifiers of similar design, but consisting of four sections of four boxes, have been built in line with the C.V. purifiers, and are served by the same travelling transporter. Instruments for indicating or controlling revivification air supply, temperatures and pressures are housed in a central position.

Meters

The meters of the 'Connersville' type are each of 2.4 mill. cu.ft. a day capacity, and are located in a central position beneath the purifiers. There is one meter to each section of the purifiers, and attached to each meter is a rate of flow indicator which enables the four gas streams to be balanced.

Construction of New Plant

The general planning of the extensions was undertaken by the Board's engineering staff, and contracts were placed at the outset for the carbonizing plant and other specialist items. The Board's staff carried out the design of the coal and coke handling plant, power house, purifiers, electrical installations and all general civil engineering work, and contracts for the constituent parts were placed item by item.

The contractors employed were as follows:—

Carbonizing Plant	Woodall-Duckham Construction Co. Ltd.
Coal and Coke Handling Plant	
Foundations and concrete structures including extension of road bridge	Peter Lind & Co. Ltd.
Belt conveyors	Hugh Wood & Co. Ltd.
Wagon tipplers	Fraser & Chalmers Ltd.
Belt weighers	Westminster Weighers Ltd.
Road weighbridge	W. & T. Avery Ltd.
Coal crushers	British Jeffrey-Diamond Ltd.
Metal detector	Goring Kerr Ltd.
Transporter	Babcock & Wilcox Ltd.
Coke screens	Robert Cort & Son Ltd.
Debreezing screens	A.C.E. Machinery Ltd.
Feeders and debreezing screens	Lockers (Engineers) Ltd.
Sack weighers	Belle Isle Co. Ltd.
Coke cutter	Phoenix Supply Co.
Portable conveyors	C. H. Johnson (Machinery) Ltd.
Railway sidings	British Transport Commission
	William Jones Ltd.
Exhausters, Ammonia Washers, Meters	W. C. Holmes & Co. Ltd.
(Exhauster engines by Belliss & Morcom Ltd.)	
Condensers	Ashmore, Benson, Pease & Co.
Electrostatic Detarrers	Whessoe Ltd.
Purifiers	
Concrete work	Peter Lind & Co. Ltd.
Box covers	Newton Chambers & Co. Ltd.
Oxide handling plant	Hugh Wood & Co. Ltd.
Mains and castings	Stanton Ironworks Co. Ltd.
	Edward Cockey & Sons Ltd.
Valves	C. & W. Walker Ltd.
Air blower	Reavell & Co. Ltd.
Oxide store structure	Ferro-Concrete (Shepperton) Ltd.
Gas Valves	Westwood & Wrights, Ltd.
	W. C. Holmes & Co. Ltd.
Main Laying	William Press & Son Ltd.
Water Cooling Tower	Davenport Engineering Co. Ltd.
Water Pumps	Sigmund Pumps Ltd.
Piping for Gas, Water, etc.	Stanton Ironworks Co. Ltd.
	Wellington Tube Co. Ltd.
	Horseley Bridge & Thomas Piggott Ltd.
Flexible Joints	Victaulic Co. Ltd.
Cocks for Water	Glenfield Kennedy Ltd.
Boiler Feed Water Treatment Plant	William Boby & Co. Ltd.
Steam Piping	Foster Brothers Ltd.
Steam Valves	Hopkinsons Ltd.
Lagging	Fibreglass Ltd.
Tar and Liquor Pumps	Joseph Evans & Sons (Wolverhampton) Ltd.
Cocks for Tar, Liquor, etc.	Audley Engineering Co. Ltd.
Pipe Gantries and Structural Steel Work	
	Carter-Horseley (Engineers) Ltd.
	Power's & Deane, Ransomes Ltd.
Instrumentation	Electroflo Meters Co. Ltd.
Electric Motors and Alternators	Lancashire Dynamo & Crypto Ltd.
(Alternator engines by Belliss & Morcom Ltd.)	
Electric Control Gear and Starters	British Thomson-Houston Co. Ltd.
	Electrical Apparatus Co. Ltd.
	Brookhirst Switchgear Ltd.
Power Factor Correction	Telegraph Condenser Co. Ltd.
Transformers	Yorkshire Transformer Co. Ltd.
Mercury Arc Rectifiers	Hackbridge & Hewittic Electric Co. Ltd.
Cables	Scottish Cables Ltd.
	Pyrotenax Ltd.
	Enfield Cables Ltd.
Lighting Fittings	Walsall Conduits Ltd.
	General Electric Co.
Power House Building	
Concrete work	Peter Lind & Co. Ltd.
Bricks	Dunbrick Ltd.
Asphalting	F. J. Prater Asphalte Co. Ltd.
Heating and Ventilating Plant	Norris Warming Co. Ltd.
Engine insulation	Armstrong Cork Co. Ltd.
Travelling crane	Vaughan Crane Co. Ltd.
Flooring tiles	Art Pavements and Decorations Ltd.
Drain Pipes and Fittings	John H. Turner & Lisney Ltd.
Manhole Covers	Dover Engineering Works Ltd.

Bricklaying, electrical installation, pipe fitting, etc., were carried out by the Board's employees. The Board acted as main contractors for all building work other than the carbonizing plant.

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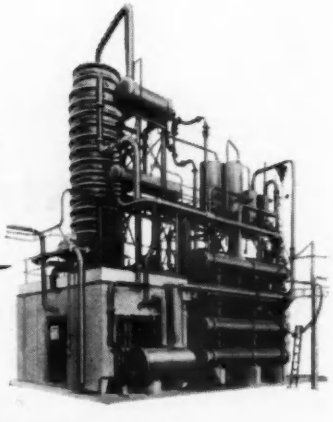

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Discussions on Institution Papers

Now that the restrictions on weight imposed by the General Post Office during the recent railway strike have been relaxed we commence publication of our edited version of the discussions on the papers presented at the 92nd annual meeting of the Institution of Gas Engineers at Southsea, May 24-27.

Accelerated Continuous Carbonization

Full-scale Development and the Utilization of Low-swelling Coals

By W. Hodkinson, T. Nicklin, and M. Redman, Chief Technical and Planning Officer, Production Engineer, and Deputy Production Engineer respectively, North Western Gas Board. (Comm. 465). **For summary of paper see 'JOURNAL' Institution Number, June 8, pp. 687-702**

MR. J. E. DAVIS (South Eastern Gas Board) said that it was more than a year since the authors of this paper made everybody re-examine their understanding of heat transfer in carbonizing plants by the publication of results obtained on the continuous vertical retorts at Rochdale. The theory of heat transmission from the setting to the coal had still not been made clear. Presumably the ability of producer gas and blue water gas to carry heat to the coal charge from the bottom of the retort—while steam displayed no such ability—was associated with the tendency of steam to expend much of the heat it received from the retort walls in endothermic reaction. The gases which did not react chemically could carry their sensible heat further.

These matters of technique and theory were of great interest and significance for further development, but Mr. Davis said that he intended to direct the main burden of his remarks to the paragraph headed 'Economics' and referring, he suspected, to costs. It was a small paragraph and not very informative. Indeed, like one of our folk songs it concluded by saying: 'If you want any more you can sing it yersen.' This was good advice: that gas engineers should think out the implications of the experiments and the results for themselves.

Coke Output

Mr. Davis then considered a continuous vertical retort with a certain daily coal throughput and steamed to produce a gas of 450 B.Th.U. per cu.ft. Steaming was then stopped. The throughput of coal per day increased. The daily volumetric output of gas remained almost unchanged, but because of the higher calorific value of the gas, the thermal output of gas was increased. No coke was then consumed in making water gas, so that the yield of coke per ton of coal was increased. This fact combined with the greater throughput of coal ensured a substantially increased daily output of coke per retort. The gas yield per ton of coal fell by the amount of water gas no longer made. The yield of coke per 100 therms of gas made was increased, because it remained as coke and not as gas.

He then assumed that the quantity of coke formerly gasified by steaming the retort was converted to water gas in a separate water gas plant, and the blue water gas was used to operate the carrier gas process. The yields of gas and of coke per ton of coal clearly returned to their original values. So also did the ratio of coke made to gas made. The throughput of coal per retort per day was further increased compared with the second set of conditions, but in order to do this it had been necessary to buy a water gas plant. He was not saying that this was a bad thing to do, but since this would have increased the capital investment it was necessary to enquire not only about the daily gas output per retort but rather about the gas output per unit of total plant employed.

Orthodox Practice

The combination of carbonizing plant with water gas plant was quite orthodox, but it was more usual to make carburetted water gas than blue water gas because of the large gain in thermal output per unit of plant. Considering such a combination of plant, the daily output of gaseous therms was, for any given calorific value, almost exactly the same whether the water gas plant was used to produce carburetted water gas and the carbonizing plant to produce straight coal gas or whether the water gas plant was used to provide blue water gas for the carrier gas system. The output of gaseous therms per day was higher the higher the calorific value.

What, then, did the carrier gas system achieve? Mainly, he considered, the replacement of enriching hydrocarbons from oil by enriching hydrocarbons from coal. This might be, in itself, a desirable end in circumstances where the cost of the hydrocarbons from coal was less than that of the hydrocarbons from oil, but it had significance also for its effect on the yield of coke per 100 therms of gas made. As long as the only raw material concerned was coal, the ratio of coke made to gas made was determined solely by the amount of coke converted to blue water gas and hence by the calorific value of the gas. For a given coal it was a matter of the ratio of enriching therms to diluent therms and nothing else. But if oil was introduced as a source of enriching therms then more coke was required to provide the diluent therms, and the coke made per 100 therms of gas had to fall. The carrier gas process avoided doing this; moreover, it avoided taking coke off the market at times when it was in most demand, namely, when the gas output was highest.

Experience at Partington

Mr. T. Biddulph Smith (Station Engineer, Partington Works, North-Western Gas Board) referred to a suggestion that there existed a possible difficulty of carbonizing coals of various swelling characteristics which might be supplied intermittently to retorts operated on the 'Rochdale' process. Partington works had always had to accept a mixture of coals of widely-varying qualities from the South Lancashire, South Yorkshire, and the Notts and Derby coalfields, the swelling indices varying from 1½ to 8. It was for this reason that when they changed over to the 'Rochdale' process, their greatest anxiety was whether the process would satisfactorily operate with these conditions, and in the early days their doubts appeared to be justified. Difficulty in keeping the retorts moving increased with the rising swelling index of the coal used, as with normal practice, but has intensified due to the considerably increased throughput, any voids produced by top hanging being lengthened at twice the normal rate. In August of last year they inserted trunk feeds, so that they were now able to make sharp changes with coals having widely varying carbonizing characteristics, with little difference in operational conditions.

To demonstrate this effectively, while operating the process on the bench of 16 retorts with a throughput of 15 tons per day per retort, and using Wath Main washed nuts (South Yorkshire BSS 4) they filled one bunker (serving four retorts) with New Stubbins washed doubles (South Yorkshire BSS 7) without informing the labour personnel of the retort house, and used this material for four days. This brought no comment from the operators, and they observed no difference between the working of these four retorts and the remaining 12, other than that the offtakes were more tarry. When carbonizing over 15 tons of coal per day in retorts having a nominal

throughput of seven tons per day, they did find, however, as in normal practice, a quicker falling off in ease of working when using highly swelling coals, but this rapidly disappeared when the throughput was reduced to that figure.

Identical Labour Force

It had been suggested by other workers that there was a necessity for doubling the labour force in the retort house when operating the 'Rochdale' process. This did not conform with their experience at Partington, where, when carbonizing in the normal way, the labour force was identical with that stated by those workers. There had never been any thought of increasing their supervisors, who quite capably dealt with the new process, or any other labour normally employed in the house, so that when the second bench was converted to the 'Rochdale' process the existing labour force of six men per shift, namely, one supervisor, two top men, one bottom man, one mechanical producer attendant, one waste-heat boiler attendant, and one screens attendant, would remain the same, plus the extra day man. Coal handling to bunkers was, of course, a different matter, and they assumed they would have to work overtime, or operate a second shift in order to raise double the normal tonnage.

Dr. J. Burns (North Thames Gas Board) said that his Board had had some degree of experience of the operation of the carrier gas process, and that there were now two examples of large-scale plant operation, one at Partington on a scale of 16 or 18 retorts and one at Bow Common on a scale of 34 retorts. He was pleased to say that there did not appear to be any technical differences whatever between the trials, and obviously there should not be in the case of trials carried out by members of the Institution of Gas Engineers.

Most Suitable Carrier Gas

Blue gas had been proved to be the most suitable gas for the carrier gas process, and, using that amount of blue gas as carrier which gave the maximum throughput possible—in other words, 14 tons—the calorific value of the gas was 450 B.Th.U. per cu.ft., the yield of gas per ton of coal being more or less the same as in ordinary conditions. There was no difficulty about that whatever. When, however, they came to higher C.V. figures, for instance 500 B.Th.U., they could not use blue water gas as a carrier, and in order to get 500 B.Th.U. gas they had to recirculate coal gas. There they were faced with a serious disappointment, because the hydrocarbons of the coal gas were seriously degraded. It has been found that the degradation was about 18%. The hydrocarbons were the most valuable product which they made, and they could not afford to lose 18% of them when their value was approximately four times the value of coke; so that with coal gas at 500 B.Th.U. the economics of carrier gas operation seemed to rule it out in the conditions of the North Thames Gas Board and of the south of England generally.

In all observations and dissertations on economics, Dr. Burns said it was very important to confine oneself to the conditions which one knew. If the facts were presented fairly and squarely, it was up to people in other parts of the country to work out the economics for their own situation themselves and to draw their own conclusions.

A Disappointment

The coke yield per ton of coal was a function of the calorific value of the gas which was made. The lower the calorific value of the gas the lower the yield of coke, because a proportion of the coke was converted into blue gas; this was done with the carrier gas process just as with ordinary steaming operations. Moreover, it was done in an external water gas generator where the efficiency was not so high and rather more coke was needed to make the blue water gas than in a retort, so that with the carrier gas process there was less coke per ton of coal. It was a very great disappointment to his Board to find that carrier gas was unsuitable for their conditons, because they should have liked to continue with it and they sought ways and means of doing so.

They looked at the possibility of using the carrier gas process by other means, making gas at 450 B.Th.U. and increasing the calorific value up to 500 by the Hall gas process. They put the carrier gas out in the field—on paper, that is—and started from scratch, taking all the items into account, such as increased coke conveying machinery and coal handling machinery which they would normally have expected to introduce with carrier gas, also the increase in the ancillary plant. They then compared the amount of gas made by such a plant with the same amount of gas—8 mill. cu.ft. per day, he thought it was—made by normal methods, water gas plus coal gas and coal gas with benzole extraction, and they found that carrier gas was the most expensive of the three, the figures being 10.8d. for the carrier gas plus Hall process, 10.2d. for the water gas plus coal gas, and 10.1d. for the coal gas with benzole extraction. They could find no use at present, therefore, for the carrier gas process at 500 B.Th.U.

West Midlands Tests

Mr. E. T. Pickering (Area Chief Chemist, West Midlands Gas Board) said that in the early summer of 1954, following a visit to the research plant of West's Gas Improvement Co., Ltd., it was decided to carry out an investigation at the West Midlands Gas Board's Central Test Works to determine the potentialities of the application of the 'Rochdale' process to the particular circumstances and requirements in the Board's area. Carbonizing plant at the Central Test Works consisted of four continuous vertical retorts of 62 in. major axis. One of the retorts was equipped with the necessary gas connections, valves, governors, meters, and safety devices required for the operation of the carrier gas process. Six series of tests had been carried out during the past year. From the commencement it was recognized that blue water gas was likely to be the more suitable carrier gas, but, as this was not immediately available, it was decided to use town gas in the initial experiments. In the first series of tests two coals were carbonized, *viz.*, Annersley D.S. washed small nuts and Silverhill washed small cobbles. The former was a coal known to travel very easily; the latter was a rather more difficult coal, because it had a higher swelling number and contained a greater proportion of fines. The tests confirmed that approximately double the nominal throughput could be obtained; but because of leakage, and degradation of hydrocarbons in the carrier gas, the thermal yields were poor.

Slack Coals Carbonized

While the first series of experiments with town gas as the carrier gas was being carried out, one of the adjacent retorts was modified in order that it could be used to generate blue water gas, which was cooled, exhausted, and metered in the second test stream before being passed back as carrier gas to the test retort. In the second series of tests, slack coals were carbonized. Two East Midlands slacks were carbonized—*viz.*, Ormonde washed smalls and Bentinck Waterloo washed smalls, and throughputs of some 40 to 50% above nominal were achieved, but bottom pressures were dangerously high. The calorific value, though low, was very steady, showing that there was little tendency for the charge to hang, also that bottom pressure could be ascribed to the closely packed charge.

For the third series of tests a small graded Yorkshire coal, Frickley Washed Peas, was used. When using blue water gas as carrier gas a throughput of 9.9 tons per day was achieved, but the calorific value of the gas was only 450 B.Th.U. cu.ft. ex retort house, which would be equivalent to about 430 B.Th.U. for the purified gas. With the object of increasing the throughput and raising the calorific value, a mixture of coal gas and blue water gas was used as carrier gas. The objectives were largely achieved, but at the sacrifice of some thermal yield. However, bottom pressure conditions became rather worse.

Imported Coal

Imported German coal, Ruhr gas nuts Type 2, was used in the fourth series of tests, having a swelling number of 4 to 5. This coal had proved an easy one to carbonize by the orthodox process. The Rochdale process worked well with fairly steady bottom pressures. Double throughputs were not obtained using blue water gas as a carrier gas, as the calorific value was considerably below that required. A mixture of town gas and blue water gas was then employed and throughput was raised to twice nominal. However, bottom pressure conditions deteriorated and the thermal yield fell badly.

By the courtesy of the North Western Gas Board, a small team of officers from the West Midlands Gas Board were able to visit Partington in September, 1954, to discuss the carrier gas process with engineers of the North Western Board. The West Midlands officers were most impressed by the excellence of the mechanical design and arrangements for the application of the carrier gas process. On their return it was decided to

carbonize one of the coals used in the Partington trials. Wath Main was chosen and a series of comparative tests was carried out. Their results, both at nominal throughput and approximately double nominal throughput, corresponded very closely with those obtained at Partington. The Central Test Works was well equipped to make accurate determinations of tar yield and they found no significant difference between the tar yields obtained from Rochdale and the orthodox processes. Tests were carried out to determine by how much the throughput could be increased when carbonizing Wath Main coal by the orthodox process. The results showed that the thermal yield per ton was maintained (H.E.V. of 31.1 in each case) with a throughput of 1.38 tons per 10 in. major axis, 50% increase above orthodox carbonization.

An Important Drawback

Dr. R. Lessing said he wished to ask the authors on which basis they had fixed the relation of carrier gas to gas actually made from the coal. It seemed to be nearly 100% of the gas made, and it appeared to him that this large volume of gas was responsible for many of the troubles which had been experienced in comparing the process in other works with what was done in the North Western region. In particular, the large quantity of gas introduced was bound to increase the pressure at the bottom, which seemed to lead to mechanical difficulties; but theoretically there was an even greater drawback, in that the increased velocity of this enormous volume of injected gas was bound to take potential gasmaking hydrocarbons out of the region of the proper carbonizing stage at which this should be done—that was to say, the particular temperature and zone where the best results could be obtained—and take them out of the system altogether. In other words, there would be a considerable amount of tarry material which should be subject to gentle decomposition in the gasmaking process which would go out of the retort before it had time to undergo this treatment.

Steam Purge

Mr. M. Sinclair Gaskill (West's Gas Improvement Co., Ltd.) thought that the sections of the paper dealing with the method of application and operation of the process were largely factual and he therefore proposed to comment on only two points. First, the length of the steam purge during discharge was considerably longer than his Company found necessary. At three minutes per discharge this represented 5% of the total working time of the retort and it was possible that this might have had some bearing on the difficulty experienced with charge travel. It was noted that this time had been reduced to two minutes, and he wished to ask the authors whether they considered this the minimum period. In the experience of his Company the continuation of the admission of purge steam throughout the entire operation, as mentioned in the paper, had been found to be the most satisfactory procedure. Second, with reference to retort operation their experience was that with coals similar to those described in the paper the travel of the charges was easier and steadier.

It was suggested that several factors might have contributed to this difference, such as the length of interruption of gas admission during purging and discharging, already mentioned, the shape of the retort (since investigations indicated that the best shape of retort for the carrier gas process would probably be circular) and the tendency, in view of the large volume of gas leaving the retort, for some of this gas to be forced into the coal in the auxiliary coal hopper. It was known that should this occur during normal operation difficulty in travel with certain coals would result. From the means by which this difficulty was overcome it appeared that this last factor was the main cause. While the system adopted was successful, it did, of course, involve an appreciable increase in heat loss in the offtake gas.

Many Techniques

It was appreciated that a very large number of applications of the process were possible. Of these possibilities they had so far investigated 10 techniques or methods of application. In each case the results had been examined to determine, as far as possible, the commercial possibilities under various conditions. From such calculations it appeared, generally speaking, that only in infrequent cases, where conditions were somewhat specialized, could the carrier gas process be shown to be economic at its present stage of development. In this economic assessment labour was obviously an important factor. The authors suggested that when using water gas injection the throughput of coal would be doubled without any increase in shift labour. In view of the fact that the number of charging and discharging operations was doubled, and taking the labour for operating the water gas plant into account, it was considered that the suggestion by Messrs. Grant and Lewis, namely, that the labour requirements would be proportional to the coal carbonized, was more realistic. This applied particularly to the adoption of the process on existing installations.

It was possible to design an installation specifically for the process and to adopt means to take advantage of its labour-saving potentialities. Estimates which had been prepared for such an installation showed, however, that its capital cost was greater than that of a normal installation of equivalent capacity. He thought the second section of the paper, on the carbonization of blended coal, was very interesting. This proposal and other systems involving the use of blended coals could be of undoubted value. A prerequisite for such processes was a constant and regular supply of the constituent coals or, alternatively, the storage and double handling of considerable amounts of coal.

There was much in this paper that was controversial, and therein lay one of its most valuable aspects. The other aspect, he suggested, was that it outlined, not a conclusion, but a beginning of techniques which in their further development would prove of undoubted value to the industry and the nation.

Author's Reply

Mr. W. Hodkinson, replying to the discussion, thanked Mr. Davis for a neat summary of the important aspects of this process. On the question of cost, by 'cost' he meant overall cost relative to their trading position, and therefore he felt that the process should be examined in relation to local conditions; but he would emphasize that in the North West, due to their coke/coal price ratio, they declared a calorific value of 450 B.Th.U. per cu.ft. In answer to Dr. Burns he said that they were satisfied that the process would deal with a wide range of coals, up to swelling number 7 at least. He agreed that it worked better with graded coals, but when the Coal Board sold them singles and doubles they really got singles down to washed slack and doubles down to washed fines. The process was operating, supposedly, on doubles but was operating, in fact, on a mixture containing anything up to 40-50% below ½ in., and it was operating satisfactorily.

Mr. Hodkinson said that they had to thank Mr. Smith for taking part in this discussion, because he had all the trials and tribulations of operating this process in its early days on a piece of plant which was expected to produce its nominal output of gas to feed the town of Manchester.

Mr. Pickering really got down to the 'meat' of this subject when he said that they had examined a number of possible applications in the West Midlands on various sizes of unit and under various conditions. He had not had the opportunity of seeing the detailed figures. He could say only that they had done similar work in the North West and were busy selling gas in a big way based on this process and with the knowledge that they could produce this gas more cheaply than by building new gasworks. It was a matter of local economics, and basically a matter of coke/coal price ratio.

Mr. Gaskill raised a number of technical points, including that of labour. The authors stated emphatically in the paper that the same labour was handling 15 tons per day per retort as handled 7½ tons per day on the installation under steaming down conditions. That was a fact, but it had been achieved by a certain amount of mechanization of the process. Those members who had been to Partington would have seen that the carrier gas process itself was completely mechanized.

Two or three speakers had mentioned the question of coke production when using the carrier gas process. In the paper the authors showed a reduction in terms of coke per ton yield, but they claimed that some 40% of that reduction was recovered in the form of additional waste-heat steam. So long as the coke/coal price ratio was below parity one could afford to lose a little yield of coke per ton in favour of increased throughput and increased productivity of capital and labour; and that condition applied in the North West. Overall, it applied in a much bigger way when they talked in terms of substantially increased gas requirements, and when they compared the carrier gas process on existing sites with building new works on new sites, the present-day capital cost of which was quite prohibitive.

THE EAST MIDLANDS 'BACKBONE' MAIN

By E. W. Pickering and J. B. Walsh, Distribution Engineers of the Notts and Derby and the Leicester and Northants Divisions respectively of the East Midlands Gas Board (Comm. 465). For summary see pp. 689-731, 'JOURNAL' Institution Number, June 8.

MR. SYDNEY SMITH (Chairman, East Midlands Gas Board), said the principle of the 'backbone' main was originally conceived by Mr. Henry F. H. Jones shortly after vesting date, when he was Chairman of the East Midlands Gas Board. At that time it was visualized that the main would be laid to form a link between Doncaster, Rotherham, and Sheffield, then to proceed south, skirting Chesterfield and Derby, to link with the existing Notts and Derby Divisional grid, in order to pick up new supplies of coke oven gas from the new Avenue coke ovens of the East Midlands Division of the National Coal Board at Wingerworth, and from the Stanton Ironworks Co., Ltd., near Nottingham; and continue via Kegworth to terminate at Leicester, as a future possibility.

The decision to build the Avenue plant had been taken prior to the nationalisation of the gas industry; and it followed, therefore, that, so far as the East Midlands Gas Board was concerned, the project was not an 'agreed scheme' in accordance with the provisions of Section 8 of the Gas Act, 1948. In the case of the Stanton extension those provisions did not apply; nor had the Iron and Steel Act, 1949, in which Section 47 imposed obligations on the nationalised steel industry to consult with the gas boards, come into operation; but, in fact, the fullest consultation took place between the Stanton Company and the Board before that Company decided to proceed with its extension scheme. In both cases, therefore, they were faced with the fact that large volumes of coke oven gas were to become independently available in a comparatively short space of time, which, if only in the interests of the national economy, should be accepted into the system.

The Scheme Amended

As the discussions continued between the Board and the two parties concerned, more positive information was brought to light; and it became apparent that the 'backbone' scheme as originally conceived would require to be amended. In both cases the Board agreed to accept the gas, provided that agreement could be reached on the price to be paid; and, in that connection, it consistently maintained that it should not be required to pay more than the cost at which it could manufacture gas in similar plant in its own works, or at near the point of usage.

In the negotiations on price, this latter point had regard to the fact that, if the gas were manufactured in the Board's works at Derby, it would not require to lay a main, as it had to do, to transmit the coke oven gas from the point of manufacture to the point of usage or, as it was in this case, to the Derby works for redistributon. The prices agreed, therefore, made allowance for the capital charges on the trunk mains laid between the coke ovens and the Derby works. They also took into account repayment of the unexpired balance of capital charges on the uneconomic works to be closed down before it could accept the large volumes of gas into its system.

Coke Oven Gas Not Cheap

Under present-day conditions there was no so-called cheap coke oven gas; and under the conditions obtaining in the East Midlands area, coal gas could be produced more cheaply in coke ovens than in any other known type of carbonizing plant. The reason for this was two-fold: (a) load factor; and (b) the coke-to-coal price ratio. The load factors of the coke oven plants from which the Board bought gas were in the region of 98%; the Board's overall load factor was around 82%; and the load factor of the Board's own plant was less than 75%. The coke-to-coal price ratio in the area was relatively favourable for normal carbonizing plants, but it was even more so for coke ovens selling hard coke in the higher-priced metallurgical and domestic and industrial coke markets. In other words, if the Board had coke ovens making gas under the same conditions as the plants from which it bought gas, and was selling coke in the same markets, it could produce gas at least as cheaply. It must also be borne clearly in mind that, although the Board was responsible for the statutory obligations of supply, no control whatever could be exercised on the manufacture of gas produced by outside interests. This was quite a serious matter.

After consideration of costs it was decided to take the new supplies into the Notts and Derby Division and southwards through Derby into the Leicester and Northants Division, beyond Leicester and down to Northampton; and to delay, for the time being, the laying of that section of the 'backbone' main designed to link Sheffield and Chesterfield. This meant that they would be transmitting gas by pipeline from the coalfield area, instead of hauling coal by rail; and they would thereby avoid the continuing increases in freight charges.

Net Savings

On the basis of 1952-53 costs, the total net savings were estimated to amount to £328,000 per annum in the year 1956-57; and, having regard to the higher prices of gas in the southern part of the area, it was decided without delay to allocate £250,000 of the anticipated annual savings to the Leicester and Northants Division, and to reserve the remaining £78,000 to cover the estimated cost of moving coke south in quantities sufficient at least to maintain the existing coke market in that part of the area. The £250,000 was equivalent to an average reduction of 1½d. per therm on the gas sold in the Leicester and Northants Division.

In the tariff revisions since March 31, 1953, opportunity had been taken in that Division, by holding prices to domestic consumers and by making concessions to non-domestic consumers in the way of constant-load discounts and special contracts, to pass on to them a considerable proportion of the allocated amount of annual savings, in anticipation of the bulk supplies of coke oven gas. The remaining amount would be conceded when tariffs were next revised in the near future. They had, in other words, cast their bread on the waters.

West Midlands Experience

Mr. F. L. Atkin (Chief Distributing Engineer, West Midlands Gas Board) said that for some time past there had been speculations on the use of either large mains with low or medium pressures or small-diameter steel mains with high pressures. There was no right answer which would cover all cases. A few calculations made fairly and without prejudice, using accepted figures, would show that the principal overriding factors were the gas quantities to be transmitted and the shape and size of the area under consideration.

In the Press recently they had had examples of each. On the one hand they had the extension to the London Gas Grid, consisting of 25 miles of 36-in. and 30-in. cast iron main working at a pressure of about 5 lb. per sq. in. and on the other hand the North Wales Grid consisting of 130 miles of 12-in., 10-in. and 8-in. mains, working at a pressure of 40-50 lb. per sq. in., which would be increased. The mains system described by the authors fell somewhere between these two examples.

At vesting date some of the units in the West Midlands were interconnected, but since then the Board had approved schemes, which were now almost completed, amounting to £1,095,000 for 74 miles of mains, which included 12 miles of 24-in., 16 miles of 18-in., and 25 miles of 12-in. It would seem, therefore, that with a population density of about 5½ times and a maximum day about double, it had been necessary to lay 74 miles of mains compared with 195 miles, at a cost of £1,094,000 and £2,612,670 respectively.

Some interesting facts emerged from this rough comparison. The first was the important influence of the population density on the economics of integration. The second was that the average overall figure in terms of cost per mile of main laid was £13,400 for the schemes described by the authors, compared with £14,700 in the Central Division of the West Midlands, which were remarkably close considering that almost all

the main laid in the West Midlands was in a built-up area. The third point was the capital costs per consumer, which for the authors' schemes for the Notts and Derby Division and Leicester and Northants was £4.05, and for the three Central Divisions of the West Midlands was £1.61.

The 'Polyflo' Computer

Lieut.-Colonel J. A. Gould (Distributing Engineer, South Eastern Gas Board) said he was glad that the authors had emphasized the work that was thrown on to the distribution departments and the steps taken to augment the drawing office staff and to provide an adequate number of clerks of works. Even with adequate technical and administrative help, the investigations involved took a considerable time to carry out, particularly where cross-country routes for the mains were concerned and this, of course, was additional to the general run of distribution planning to meet building developments and repair and maintenance work which must be dealt with daily.

Every aid that the distributing engineer could employ in helping him to deal with the great amount of detailed investigatory work was valuable. In that connection he referred to an American flow computer known as the 'Polyflo,' which he obtained in 1946 and now found indispensable in dealing with large transmission problems. The computer, which was in the form of a circular slide-rule, would deal with volumes up to 100 mill. cu.ft. per hour over a maximum distance of 1,000 miles, and thus covered every calculation likely to be met with in Great Britain. It took account of varying friction factors, and so on. There was, unfortunately, as far as he knew, no British equivalent covering the range necessary in these problems. There was another circular range which was very good, but it did not provide for the same range as the American instrument.

With regard to the route for the 'backbone' main, he was interested in the large number of easements and wayleaves secured—*i.e.*, approximately 350, and he asked the authors whether they could say what the prevalent capital cost per yard was in respect of the perpetual easements, such, for instance, as 1s. or 2s. per yard. He realized that there were cases where exceptional payments had to be made. The South Eastern Gas Board also sought to obtain easements in fee simple and had been extraordinarily successful. It had experienced the advantage of employing land agents when negotiating easements.

With regard to the 27-in. steel main laid between Derby and Kegworth, he asked the authors to state the thickness of the steel, which he had assumed from the figures they gave in respect of the ultimate bursting and test pressures, to be $\frac{9}{32}$ in., which was the lesser of the two thicknesses given in Table 2 of B.S. 534, which thickness, considered in conjunction with the ultimate bursting pressure stated in the paper (1,010 lb. per sq. in.) would give an equivalent tensile stress of 21.65 tons per sq. in. He assumed that as each of the individual welded joints was air tested to 80 lb. per sq. in. pressure, no special tests of the welds were made by such means as X-rays, gamma rays, etc.

Cathodic Protection

Apart from external protection, he assumed that there was no immediate intention to install a cathodic protection system to the steel main. It would be interesting, however, to know whether any provision was made (in the form of electrical test points) for testing the pipe/soil potentials at some future date and whether the main was made electrically continuous having cathodic protection in mind.

With the general use of higher transmission pressures and the limiting safe pressures which could be operated in spun iron mains, distributing engineers generally were having to make close comparisons between the cost of steel and iron mains, and it had been his experience that a steel main was generally more expensive than a spun iron main, particularly if costs of welding supervision had to be taken into account. There was the further point that the way was not yet entirely clear for the general application of cathodic protection systems, particularly by impressed current, in situations where other undertakers' mains might be affected, although this matter was receiving the attention of a Joint Co-ordinating Committee on Cathodic Protection, on which the Gas Council was represented by members of the Institution.

Mr. Henry F. H. Jones (Deputy Chairman, Gas Council) congratulated the authors on 'an amazing record of achievement.' The scheme was not yet complete. He hoped that eventually the main would expand to Doncaster and even beyond at one end and to Northampton and beyond at the other, with a continuous link in between; but that would not be achieved until the time arrived when it was economically desirable. On the question of main sizes and pressures, he sometimes heard the comment that there was something wrong with the gas industry because it did not lay hundreds of miles of mains with gas inside them at enormously high pressures, as in American practice, where there were mains over very long distances at pressures of 40, 50 or 60 atmospheres, and perhaps even more.

There was an excellent paper by Stephen Lacey a good many years ago on which most of such work as he (Mr. Jones) had done on gas distribution calculations had been based. It was clear from that paper that to transmit a given quantity of gas over a given distance required a pipe of a given size ideally, but that in arriving at that size it was necessary to know the capital cost of laying mains of various sizes and the cost of power. If one drew a curve of cost against size of pipe one usually found that there were, say, two sizes of pipe which gave equal cost, taking an assumed load, and one had to decide which size to lay; and which size one decided on depended, as in the case of this main, on the estimated future load by comparison with the actual present load.

Rising Capital Costs

In the circumstances of this country, and he thought he could say with confidence in the East Midlands, the distances and quantities were not related in such a way—or at any rate they had not been so up to now; he did not say that they never would—as to justify these very high pressures, because for a given quantity of gas the longer the distance they wanted to send it the smaller the pipe required economically, while for short or medium distances the pipe had to be large for the best economy, taking the normal relationship of cost of power and cost of pipe.

There was, however, one feature not brought into their calculations. He had only seen it brought into one estimate for a main-laying scheme, and that was in America. The assumption there was that capital costs would rise each year—*i.e.*, the cost index, at something like 3% per annum. If that was going to happen, it justified choosing a larger and more expensive main today; because the cost of power they could expect in the long term to rise by 3% per annum, but once the main had been laid that cost was fixed and could not increase once the job was done; it remained constant while the costs of labour, power and fuel continued to rise.

Small Storage Capacity

Mr. W. A. B. Hoskin (Immediate Past President, Coke Oven Managers' Association) said there was no doubt that the question of supplying coke oven gas to a large grid was a very important factor in the economic life of the Midlands, and the question of costs was one which would have to be faced and solved. He was surprised to see the comparatively small storage capacity mentioned in the paper. He had calculated that something like 70 mill. cu.ft. per day was being taken by the grid, and the total storage capacity available was only 33 mill., or something less than 12 hours' supply. It was not for him to say what the figure should be, but when difficulties were encountered, as they had been owing to the coal strike in the last few weeks, small stocks such as these tended to make the difficulties much greater.

Mr. J. Foxton (Senior Chemist, Cheltenham Division, South Western Gas Board) said he presumed that, to meet peak demands, the fullest use would be made of the vertical retort plant, together with fairly heavy oiling in the water gas plant, in order to maintain calorific value. At times of peak demand, would benzole scrubbing be reduced? Under these conditions, would the authors expect a loss of calorific value in the high-pressure system? There was no doubt that, unless oil scrubbing was practised when coal gas and carburetted water gas had to be compressed to any great extent for subsequent distribution, a loss of calorific value would occur. A study of the partial pressures of the condensible hydrocarbons present in coal and water gases would confirm that. A normal unstripped coal gas had a partial pressure of benzole of about 7 mm.

(*Concluded on p. 847*)

THE DOMESTIC LOAD: TRENDS and INFLUENCES

By A. V. Horsfall, Sales and Service Manager, West Midlands Gas Board (Comm. 467).

For summary see Institution Number, June 8 (pp. 699-731).

MR. L. W. ANDREW (Director, Watson House) who opened the discussion, said that apart from the general value of such discussion, it helped in the solution of a very real problem of a testing, development and research organization, which was to ensure that the work was in the right channels and had the right priority, and that the results obtained were made available and used quickly. Some of them had found the paper a little depressing, but he understood from the author that it was meant to be, not depressing, but controversial, and to act as a spur to them all. The author was right in his belief that they had a tough fight ahead for the domestic load, but he brought out two encouraging facts—electrical competition and the Beaver Report,

Benefits of Competition

Looking back over the last 20 years or so, the very real fact of electrical competition had time and time again proved of the greatest possible value in research and development work. It had made it necessary to raise their standards and produce new appliances, and that had always happened. He believed it to be fundamentally true that potentially they could give a service to the user which was both better and frequently cheaper by gas and coke than that which could be obtained from any other fuel or combination of fuels. If that was so, then they must be able to develop appliances and loads which could not fail to succeed. It was a compliment to the industry that gas consumption was falling for a given standard of service. In fact, much of their publicity was directly based on that. But the possibilities of an increase in consumption lay not only in the selling of more appliances, which the author emphasized so strongly, but also in the potential increase in the standard of living which was so necessary in this country at the moment.

The figures for relative sales of gas and electric cookers over the last few years were no doubt correct, but they could well be misinterpreted and misquoted by malicious people. The author toned them down by reference to rural electrification, and he might well have added that those figures were in no way reflected in the ratio of gas to electric cookers installed in urban districts under conditions where there was free competition and freedom of choice to the user between gas and electricity. In the London area, the ratio of 4:1 in favour of gas had not been undermined, and he believed that that situation applied in many parts of the country. There was no doubt about the efforts made to popularize electric cookers, and there was no room whatsoever for complacency, but he believed their own developments and above all their intentions were such that they were at least keeping pace with their competitors.

The Pressure Cooker

Most of the recommendations dealing with cookers were under active consideration, but he excepted the buiding in of a pressure cooking vessel as an integral part of a gas cooker. There was some doubt concerning the popularity of this component after the initial enthusiasm had worn off, and he felt that if a pressure cooker was used it should be used on the normal gas ring or hotplate, which was eminently suitable for it. He confirmed the great importance of all types of improved ignition, from the point of view of safety in use as well as convenience.

Dealing with gas fires, the author underlined some difficulties in providing a flue for a gas fire, but he might well have emphasized more the great advantages inherent in a gas fire, with its type of heating and proper standard of permanent ventilation. It should be possible to sell more flued gas fires on the basis of comfort service given, particularly now that the convector gas fire was well established. He agreed that they must do more about flues, but suggested that the greater part of the necessary information was available already, and it was a question of putting it over in a wholehearted way to the architect and the builder, and possibly, in some cases, to their own utilization friends. He felt that it was unreal of the author to suggest that the construction and appearance of gas fires had not changed much over say, 20 years. He regarded the modern radiant and the wider introduction of non-aerated burners as fundamental changes which affected practical performance and appearance to a marked extent, and brought the appearance of modern fires in line with modern architecture and current taste.

Free Standing Fire

It was a surprise to find no reference to balanced flue appliances, but a serious omission was the lack of reference to the need to develop a free standing fire. Such a fire, which made the very important convector fire a simpler and more efficient appliance to design, had often been discussed, and the time had come to do something about it. He agreed that such an appliance needed a simple recess rather than a conventional fireplace, but the advantages were so great that everything possible should be done to achieve that end. Activities were taking place on water heating to produce the developments suggested, but he was surprised that the author had not referred to the instantaneous bath water heater.

He reminded the author that appliances were only a means to an end. It was the service to the user by which they were judged. It might well be that the choice of the correct appliance, first-class installation and operating instructions and maintenance to give full service at all times, would give higher consumption per user with existing appliances. The best conclusion to comments on the paper was to quote from the President, when he spoke of the opportunity and challenge of the Beaver Report and of the 'importance to the gas industry of maintaining a body of scientifically qualified professional men that is of the highest order.'

Effect of Price on Sales

Mr. F. Harvey (Walsall, West Midlands Gas Board) said that in the section dealing with factors influencing the domestic load, the author suggested that the increase in the price of gas might have had a pronounced influence on domestic sales. While it was an obvious economic truth that the higher the price of a commodity the lower the sales were likely to be, it was difficult to trace any relationship between rises in prices and decreases in domestic gas sales. In the first few years after the war gas consumption increased despite successively higher charges, but that was followed by a fairly steady decrease in similar circumstances. In the case of the West Midlands Board the price of gas had been maintained at the same level for the past two years, and, although consumers' wages during the same period had steadily increased, the decline in domestic sales had been fairly comparable with that which had taken place in other areas where the same stability of gas prices had not obtained. Such conclusion, while it was unpopular with most of them, was inescapable. He could only suggest that they must look elsewhere for other and more important reasons for the downward trend in the consumption per domestic consumer.

Reasons for Downward Trend

First came the replacement of obsolete cookers. As an instance of the significance of that factor he quoted a case of which he had knowledge, a district of 120 consumers where 15% of the total cookers had been replaced since the war. If it was assumed that the efficiency of the new appliances was 20% higher than that of the old ones—and it might be more—that factor alone would account for a decrease in consumption of 3%, or just over 0.5% per annum.

In the second place there was the effect of slum clearance schemes, which had been under-estimated by the author. Apart from the effect of the dispersion of families, the straightforward transfer of households from old to new property inevitably resulted in halving the gas consumption. There were many properties in the industrial areas of the West Midlands where the average annual consumption had been over 200 therms in the old property, but on the new housing estates they could expect only about 100. That factor would be of

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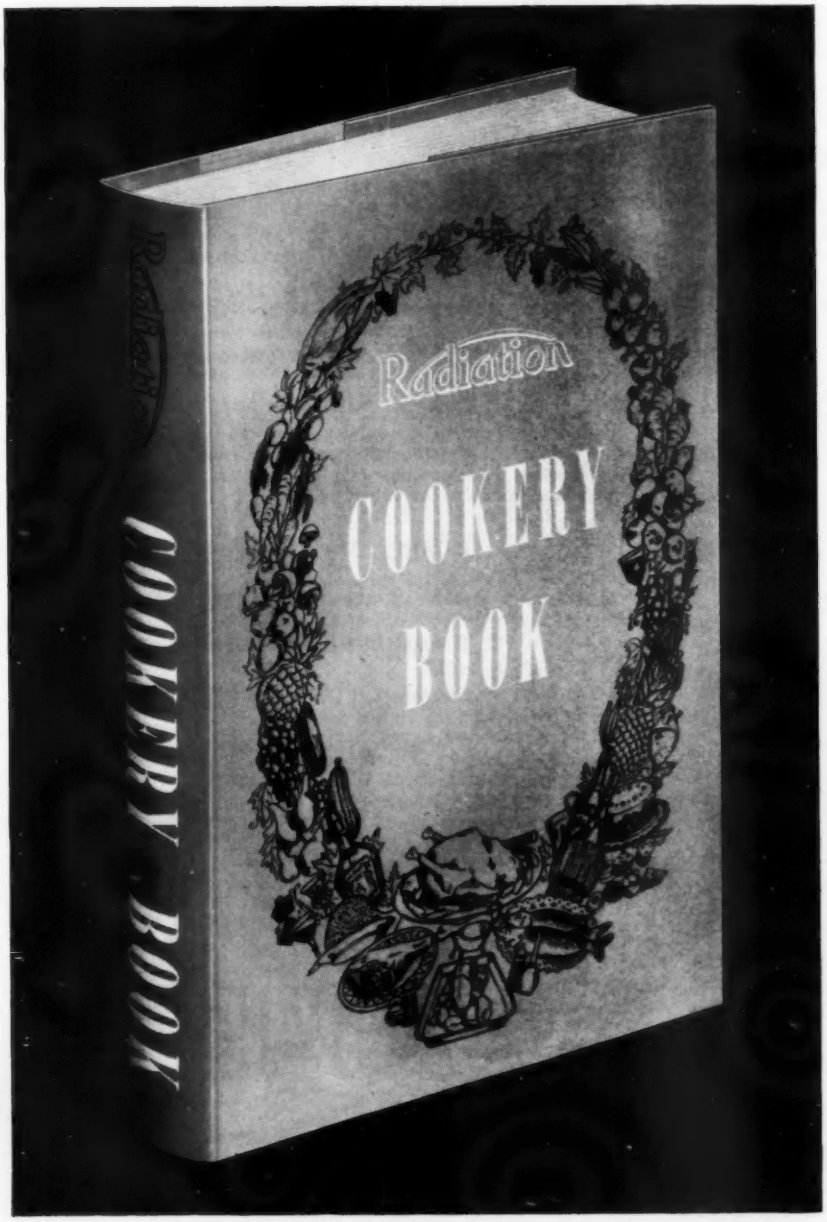

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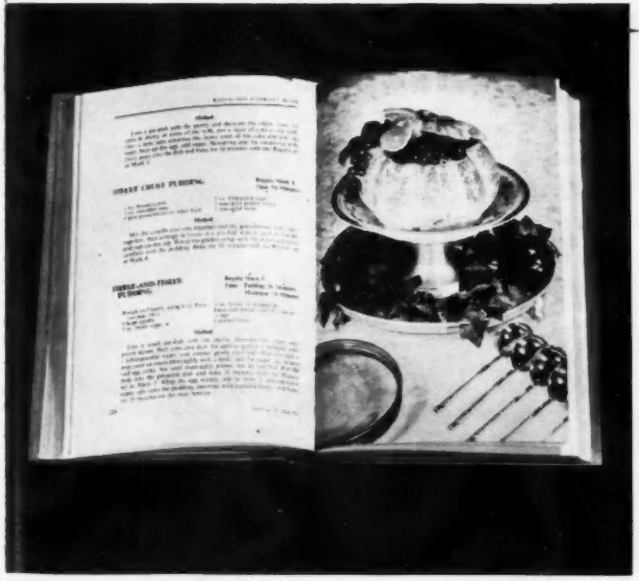

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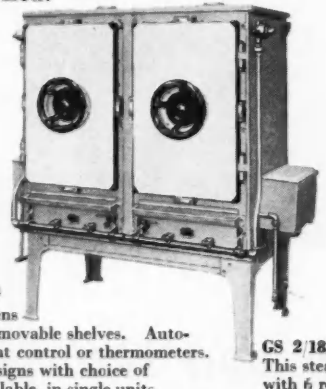

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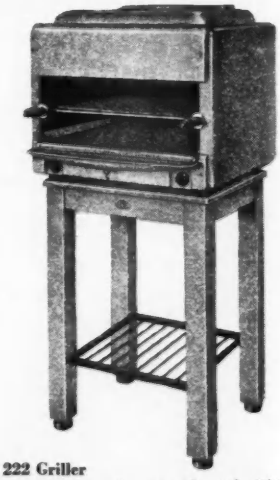

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increasing importance as the proportion of new houses allocated for sum clearance steadily increased.

A third reason was the increase in popularity of the mechanical washing machine, together with the much higher standard of hot water heating provided in the new housing estates, where the need to heat the water in the machine itself no longer existed. Prior to the war one could expect to sell about the same numbers of cookers and wash boilers, but of recent years the proportion of wash boilers had dropped. Finally, though it was not mentioned in the paper, there was no doubt that the availability of alternative fuels had had an influence on the sales per consumer, and the availability of solid fuel now was much better than it was in the years immediately following the war.

Consumer Load Statistics

The consumer load analysis confirmed in no uncertain manner the load-building value of the whole-house water-heating load and the doubtful value of the single-point water heater. It was a fact that the imposition of a high rate of purchase tax on that type of appliance had militated against rapid development, but even in those circumstances he suggested that the industry as a whole had failed and he did not think that it was an exaggeration to say lamentably failed—to obtain a satisfactory shares of the business, compared with its principal competitors. Some features were particularly noticeable in the proportion of new property fitted with gas water heaters. With the exception of blocks of flats, the installation of gas water heating in new housing was the exception rather than the rule, and in consequence the consumption per consumer on new estates had been in some cases very unsatisfactory. As a possible solution to this problem, it was suggested that attention should be given to the design of a simple independent coke boiler, which offered the cheapest and probably the most economic method of house water-heating, with provision for gas heating in an emergency. The device need not be built into the appliance or achieve a high thermal efficiency, as it would be used only infrequently.

In seeking means to obtain a higher proportion of that most attractive load, he supported the author's plea for an attractive tariff based on a realistic assessment of the competition which they had to face. With cooking, space-heating and other uses for gas the speed, efficiency, and ease of control of their product were attractive to the consumer, but in the case of water-heating one gallon of hot water was exactly the same as another gallon of hot water, in whatever way it was provided, and the annual cost of providing the service was the only criterion on which the consumer decided. The existing block systems of charging for gas, in operation in most areas, did not place sufficient emphasis on the value of large domestic consumers, and frequently the differential between the initial and subsequent blocks was not sufficient to make it attractive for a consumer to displace other fuels.

The excellent load factor of the normal low-consumption water storage-heater and the fact that a load of that type could generally be accommodated without enlargement of the distribution system, service pipes or consumer's meter, would appear to justify a price of gas approaching the terms normally applicable only to large industrial consumers. He did not agree, however, with the author's suggestion for separate metering of gas for combined space and water heating. The same result could be achieved at lower cost and less inconvenience to the consumer by a suitable two-part tariff, possibly restricted to consumers using water heaters of specified types. It was, moreover, psychologically unsound to charge two different prices for gas used on the same premises, as the consumer could not understand why gas from the same pipes for two purposes should be at two different prices.

Low Thermal Input Heater

He was interested in the author's suggestion for the development of a simple low thermal input heater capable of attachment to an existing hot water cylinder, as some years ago he experimented with a similar type of apparatus. The device consisted of a burner fitted to an ordinary 30-gal. tank, lagged on the top half only. For simplicity, cheapness, and ease of maintenance no thermostat was included, the reason being that the heat losses from the unlagged section of the tank would prevent overheating. The maximum gas consumption was about 4½ therms per week. Broadly speaking the appliance worked quite well, but serious difficulties were encountered in the end in avoiding condensation in certain circumstances, and due to lack of time and facilities the experiment was abandoned.

The author suggested that consumers should be encouraged to maintain their own appliances. The high overhead charges associated with that type of work, which as a rule involved a high ratio of travelling to working time, made maintenance expensive, and there was already evidence that consumers resented charges of that nature. The higher rates of pay to skilled chaftsmen, which were fully justified for skilled men, had meant increasing demands on the purse of the householder; and, when one saw some of the work carried out successfully by ordinary men and women, with the encouragement of various 'Do It Yourself' publications, it would not appear to be beyond the capacity of the consumer to carry out simple maintenance work such as cleaning refrigerator flues and even servicing a gas fire. The danger was that the consumer would attempt jobs beyond his capacity and leave appliances in an unsafe condition. That might be overcome by suitable instructions or training manuals.

Basis of Gas Charges

Mr. J. E. Wakeford (Divisional General Manager, Birmingham) said he regretted to note the very few lines which the author had devoted to what in his opinion was the most important influence on domestic gas sales—the basis of gas charges. In the average household in the Birmingham Division the charge for the first 60 units (or two therms) of electricity consumed each quarter was 10s. per therm, and for all consumption in excess of that quantity, the price was reduced to one-quarter of the maximum, namely 1d. per unit or 2s. 6d. per therm. By that means the electricity industry was assured of receiving a fair contribution to its standing charges from almost every consumer, and was thereby in a position to sell its commodity at a price almost equal to the bare cost of production. In the gas industry, on the other hand, they continued in the main to spread the standing charges over comparatively large first and succeeding blocks in their tariffs, with the result that the small consumer paid little towards his fair standing charges and was being subsidised by his neighbours, who in turn paid much more than was equitable.

He had looked broadly into that problem in respect of Birmingham, which in gas production represented one-twentieth of the total gas industry and one-thirtieth of the total gas consumers in this country. The investigation revealed that the true standing charge to each domestic consumer, regardless of gas consumption, was approximately 18s. per quarter. If they all paid their fair share in that connection, the price of the commodity to that class of consumer could then be reduced by about 5½d. per therm. In other words, that course would be possible if their initial charges on a thermal basis were equivalent to that of their electrical competitors. The real remedy for the present state of affairs, therefore, and the real way to secure the promotion of gas sales to domestic consumers, with the consequent immense contribution which that would make to implementing the Beaver Report on clean air, was in their own hands. The industry should be bold and tackle that important problem.

It might be said that such a proposal at this time was politically inexpedient, but surely they could not be condemned for suggesting measures which were sound and equitable and undoubtedly in the national interest. More than 25 years ago they pleaded that legislation should be amended so that fair tariffs could be formulated to enable the industry to be on all fours with electricity. Six years had now elapsed since the wish was granted, making it possible to confer immense benefits on the 13 mill. consumers of gas. After many years of propaganda the Beaver Committee had brought the smoke abatement problem into correct focus. He believed that only a Select Committee of all political parties would bring into its true perspective the right outlook on gas charges.

Contrasts Between Prepayment and Credit Sales

Mr. G. H. W. Madge (Divisional Manager, Central Division, North Thames Gas Board) pointed out that in considering factors influencing the domestic load the author quoted a reduction in consumption despite an increase in the number of consumers. This was not altogether a new phenomenon, as there were indications of it before the war. There were many

reasons for it, and the author had made a good attempt to explain some of the principal ones. The reduction in domestic gas consumption was twice as marked, he said, for prepayment as for credit consumers. That was the universal experience. Prepayment consumption per consumer had risen greatly since the war. Comparing 1938 with 1946-47, on a per consumer basis there had been a big increase, amounting in his Board to 40% per consumer.

Canteen meals were a sign of the times and had meant a terrific transfer of consumption from domestic to commercial, but it was not really lost. With regard to launderettes, the author and a subsequent speaker had referred to the loss of the domestic wash boiler consumption in many cases. This was true and made it all the more important for them to get into the washing machine field and to see that the water heating in launderettes was done by gas.

Oil Competition

The effects of atmospheric temperature appeared to have been in their favour yet not to have influenced domestic consumption appropriately. That was, no doubt, due to competition from various sources, and largely, he thought, oil heaters as well as electric. There had probably been a loss of domestic gas cooker space heating to oil heaters in many humble homes.

The author gave imposing figures for the sale of electric appliances, and he said that they did not know how many of them had displaced gas appliances. They did not, but in the area with which he was concerned they had a fairly good clue so far as cookers were concerned, and it was some comfort to know that the figures tended to show that the marked tendency which existed before the war for electric cookers to displace gas cookers had been checked, if not actually reversed.

In dealing with the load-building value of appliances the author was right in spotlighting the appliances which he did, and he made some interesting remarks on water and space heating, to which undoubtedly they must look. He was not sure that he agreed with him, however, on the separate metering of water heating and space heating; it was complicated, and he did not like complications. He might have an idea there, however, which they could not ignore. Finally, he applauded the author's view that efforts must be concentrated on selling two appliances where one was sold before, thus making the desert blossom like a rose; and appliance sales must not only pay for themselves but make some contribution to revenue. For that reason he favoured the inclusion of an adequate overhead.

Mr. W. G. Phillips (Commercial Manager, Watford Division, Eastern Gas Board) said the author seemed to favour the development of the use of electricity for the ignition of the gas cooker. He wholeheartedly agreed with this view. Surely the time had come when it should be realized that electricity could be of assistance to the industry for igniting and automatically controlling appliances? Such a policy had long been accepted in the United States, and time-controlled operation of the oven, for instance, was very common there. Most of the larger range manufacturers produced models in which the oven section could be turned on and shut off entirely automatically at any pre-determined time, which was accomplished through the use of an electric clock and timer mechanism in connection with an appropriate gas valve.

In a recent nation-wide survey of the American housewives' preferences for features regarded as essential in gas cookers, automatic control headed the list. The automatic clock control on a gas range in the States was now recognized as a boon to busy homemakers and employed women who were away from home all day. It was appreciated that clock-controlled oven cooking must be used with some degree of caution, so that there was no fear of spoiling the food during 'standing time,' but no more, he suggested, than was used with many types of food cooking.

Productivity Team's Report

The gas industry's Productivity Team, which visited the States in 1952, in the conclusions and recommendations of its report, referred to the fact that in the States there was no hesitation in adopting the use of electrical accessories in gas appliances, and that the appeal of those automatic devices to the housewife in America would also be found in Britain. After, he suggested, some heart-searching within the industry, that principle had been readily accepted in the washing machine.

The author referred to the competition of the immersion heater in the water-heating field. Those concerned with the commercial activities of the industry realized how strong that threat was, particularly in respect of the summer water-heating load. For reasons stated in the paper—cheapness of first cost, installation and so on—immersion heaters were becoming increasingly popular with local authorities and house developers, who in many cases were installing them or making provision for them in their houses at a nominal increase in rent to their tenants. He would welcome the author's views on a suggestion to develop a solid fuel grate with back boiler having an integral gas burner attachment for summer water-heating, which could be provided at a price competitive with the immersion heater system.

Combined Washer-dryer

The author referred to the ingenious suggestion to develop a washing machine and clothes-drying cabinet combined in one appliance. The former British Gas Federation arranged for Miss Jane Drew, the well-known architect, to visit America in 1944 to obtain information concerning kitchen designs and heating systems with a view to helping British post-war housing designs. She made a very comprehensive report, and one suggestion which she made was that we should develop a cheap dryer on the rotary drum principle in this country. In the report of the industry's Productivity Team which visited the States, a similar recommendation was made.

To the list of items of significance which the author gave in relation to organic sulphur compounds, he suggested that there might be added the deleterious effects on fabrics and certain materials. It would be remembered that the Egerton Report referred to that fact in an appendix when dealing with the flueless gas heater. Mention was made in the paper of the effect of the presence of oxides of sulphur on the dew-point of the products of combustion. That was, he suggested, extremely important in view of its connection with certain loads, and not nearly enough attention had been given to the problem. He was sorry that the author, having so ably marshalled all the facts concerning the disadvantages of the continuing and likely increase in the presence of sulphur compounds in town gas, did not appear to come down fair and square on the side of its removal. While he agreed that the removal of sulphur would not automatically guarantee an increase in gas sales, he suggested that the cost of such an improvement in its end-product would be borne by a commercial undertaking. In his view the visible deposits and stains and the smell of sulphur compounds from the products of combustion conveyed to their customers a totally erroneous view that town gas was a dirty fuel. He therefore put forward the view that the present cost to the industry of not removing sulphur should be given careful consideration.

Education and Training

Mr. W. T. Lane (Area Development Department, South Western Gas Board) said the main theme of the paper was concerned with some careful reasoning as to the reasons for which the total domestic gas consumption was declining and how improvements in appliance design and application might assist in obtaining additional sales. While he appreciated that this was a paper addressed to the Institution of Gas Engineers and therefore might, quite rightly, be more concerned with the technical approach than with the commercial approach, it occurred to him that some reference to salesmanship and the importance of education and training as a present and future policy should have been included. In fact, the one essential point that had been omitted, in his opinion, was the human selling factor.

Assuming that the technical staff within the industry and those available on the appliance manufacturers' side were capable of continuing their research, the fact still remained that, having secured from the manufacturers suitable appliances of improved design and performance, the advantages which those appliances possessed must be conveyed to potential consumers in terms of how it would benefit them. Things would not sell themselves; values had to be developed in the minds of the prospective user. Quality might be built into the appliance, but the value and desirability depended on the influence exerted by advertising and selling. The entire effort must be centred on the consumer.

What the industry needed today, more perhaps than at

any other time, was to recognize the fact that there was still no substitute for plain hard selling, and all the appurtenances —market research and the like—referred to in the paper were little more than tools. They might possess some value, but they were not selling. They were intended to make the main stream of the selling effort flow more directly. Informative as the paper might be, unless they recognized the essential importance of the properly-trained salesman the substance of the paper was of little value.

The Author Replies

Mr. A. V. Horsfall, replying to the discussion, said Mr. Andrew had mentioned the success of cookers and seemed to think that he was saying that they need not worry too much about cookers. They must do so; they were their best load and they must retain it. He referred to the ratio of 4:1 of gas cookers against electric cookers in the North Thames area. In the West Midlands, too, they were doing well, and had about 85% success with cookers on new housing estates. He had also mentioned flues for gas fires and the extended use of balanced flues for such fires. He wholeheartedly agreed, and thought that the balanced flue fire might be a useful appliance for the future; but they had not got it, and they wanted to develop the free-standing and the portable fire, which gave them a very good load indeed. Several speakers had referred to combined gas and coke appliances for summer and winter space- and water-heating. He entirely agreed. That was one of the essential appliances which they needed. He knew of some work which was going on to produce such an appliance, which would have very good efficiency and help considerably not only in developing their load but in giving clean air.

He had been interested in the comments of Mr. Harvey and Mr. Wakeford on gas prices. Comment was made by other speakers on the use of separate meters for recording the consumption of space and water heaters. He had yet to be convinced that the average consumer fully appreciated and understood what they meant by a two-part tariff. Consumers found it confusing, and a better way of dealing with the problem was to give them a direct means by which they could, if they wished, see how much gas they were using, knowing that the amount which they used for special purposes would be recorded separately and they could see clearly how they were going on.

New Cookers—More Cooking

On the question of the replacement of obsolete cookers by more efficient cookers, it was a fact that they did not lose consumption all the time, because many housewives when they got the new cooker were so enthusiastic that they did more cooking than ever before. Mr. Madge had referred to the extraordinary fact, mentioned in the paper, that the reduction in consumption was greater with prepayment than with credit consumers. It might be explained by the fact that people who had to put the money in to get the gas realized better what they were doing than those who got their supply through a credit meter. Mr. Madge had also said that with appliance sales they should make sure that they added adequate overheads to cover all their costs, and he agreed. Appliance sales must stand on their own feet, and generally they did pay for themselves.

He was interested in what Mr. Phillips had said about the use of electricity in gas appliances, especially for ignition purposes. The question of ignition was most important to them, and if they could use electricity satisfactorily for ignition it would help them very much. On the question of sulphur, Mr. Phillips was not sure whether he (Mr. Horsfall) was saying that they should remove it or whether he was lukewarm about it. He wholeheartedly agreed that the removal of sulphur would help tremendously, not necessarily to increase gas sales but to popularize even more the use of gas in all kinds of fields. It had been suggested that they should do more to educate their staff and personnel. They had good salesmen, but they wanted to do more education of the public, to make them realize the benefits which they could get by installing more gas appliances. That was where the need for more education really lay.

EAST MIDLANDS BACKBONE—from p. 839

mercury, equivalent to about 1% by volume of the gas. At pressures of around 40 lb. per sq. in. and temperatures in the gas main of 5° to 10°C., some of the higher boiling compounds, present in the gas as a vapour, would begin to assume a liquid phase. Once that high-boiling material began to be deposited, scrubbing of the gas, and consequent partial removal of the lower-boiling vapours—*e.g.*, xylene, would occur.

With an average carburetted water gas, owing to the possibility of the production of greater yields of high-boiling fractions (as vapour) in the gas, deposition of hydrocarbons from the gas could be expected at pressures considerably below 40 lb. per sq. in. At times of peak demand, there was the possibility that losses of calorific value might begin to occur when the gas was compressed to pressures as low as 15 lb. per sq. in. The high-boiling hydrocarbons must be removed from the gas by oil washing if losses were to be avoided in high-pressure gas distribution systems. The higher the pressure, the more complete must be the elimination of these hydrocarbons.

Mr. Walsh's Reply

Mr. J. B. Walsh, replying to the discussion, said many factors contributed to the design of a grid or major linkage system, and the incidence of coke ovens, the disposition of undertakings of various sizes, and the conditions of the plant therein had all influenced the pattern of interlinkage described in the paper. It was appreciated that in describing a 'backbone' main designed to meet specific conditions in the East Midlands area the circumstances in other areas might warrant, on technical and economic grounds, a system of an entirely different shape.

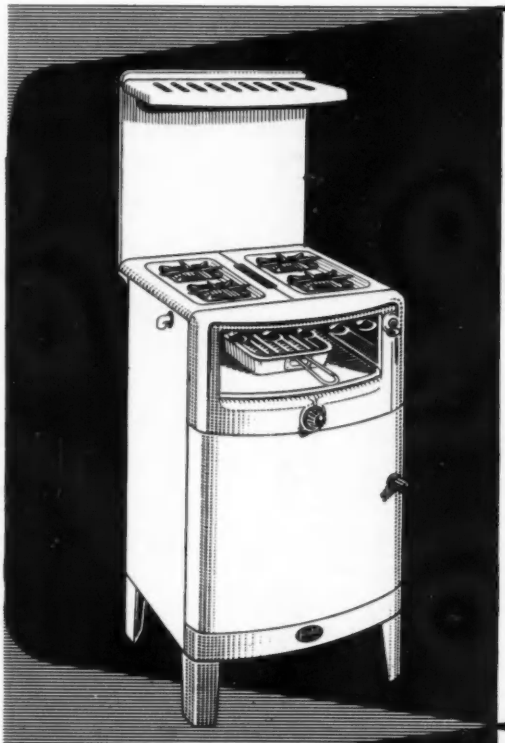
Mr. Atkin raised the question of high test pressures on the spun iron sections. The sizes and pressures adopted were the result of a tremendous number of calculations in the approved method. They made a very complete survey of all the divisional areas. Perhaps in the determination of the ultimate quantity of gas to be delivered to the different undertakings they had taken what might be regarded as an optimistic view of future consumption, but, having arrived at that figure, full calculations were made, and they arrived at a combination of size and pressure on which the grid was based.

He had been interested to hear Colonel Gould mention the 'Polyflo' flow computer. It would have been very useful to them several years ago, when these very extensive calculations were begun, if they had had such a calculator available, because unfortunately all the charts and flow diagrams which they had at that time seemed to finish at a quantity and length totally inadequate to their requirements.

With regard to the payment of easements, on an average they paid something like 2s. a yard for a 24-in. main easement. For the smaller mains, where they did not establish standard payments, they were roughly in proportion to the size. The 27-in. steel main had a thickness of $\frac{9}{32}$ in. No X-ray tests were made of the steel main. The steel main had been made electrically continuous with a view to the application of cathodic protection when agreement had been reached with the other authorities concerned.

In reply to Mr. Hoskin, the subsidence areas of the grid main were confined almost entirely to the Notts and Derby Division. There was a main in that Divison which had been laid for 23 years, working at a pressure of 10 lb. per sq. in., and no trouble had been experienced during that time with the joint. There was, of course, continuous movement in the area around the main and fractures had occurred, but the joint itself had stood the test of time. The CL type of valve had in the tests so far carried out proved entirely satisfactory.

IN THE FIRST QUARTER of this year, British firms received orders for oil equipment and materials valued at £32.8 mill., an increase of 40% or well over £9 mill. on the previous quarter. The figures include a large proportion of orders for use overseas. The principal categories in the first quarter's total included tubulars, pipefittings and valves (£4.1 mill.), specified drilling, etc., equipment (£2.8 mill.), drums, drumsheets and tinplate (£2.3 mill.), prime movers and compressors (£1.9 mill.), electrical equipment (£1.9 mill.), and specialised equipment for refineries (£1.8 mill.). Britain's chemical firms benefited from oil company orders to a total of £8.7 mill.



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TOWN GAS AND INDUSTRY'S CHANGING NEEDS

By R. F. Hayman, Industrial Gas Officer, Gas Council, and E. A. K. Patrick, Watson House (Comm. No. 469). For summary see 'JOURNAL' Institution Number, June 8, pp. 697-732.

MR. J. T. HAYNES (Divisional General Manager, Western Division, Southern Gas Board) said that it needed only a short experience in the industrial field to appreciate that an industrial gas engineer, by persuading the management of even a small factory to use gas as a fuel, increased the load on the gas undertaking to an amount equal to that of a large housing estate requiring four or five salesmen. The industrial gas engineer had to convince his client that gas as a fuel would do the client's job better, cleaner, quicker and cheaper than any other fuel, and, having persuaded his client, he then sometimes had to assist in the design and even in the construction of the apparatus necessary to use the gas. It was perhaps unfair to make comparisons, but when the industry was faced with a continuously decreasing consumption per domestic consumer, one wondered whether the industrial gas engineer was not a more successful gas salesman than the so-called salesman and showroom assistant, although he got rather less recognition. The industrial salesman not only had to obtain additional gas loads, but had to work hard, continuously giving service in order to ensure that the gas was not displaced by other competitive fuels; if once such a loss did occur the gas industry could say goodbye to that load for ten years or more.

Mr. Haynes emphasized that the industrial gas engineer must know his local industrialists and the local conditions. The many small factories dotted about an area preferred contact by local men rather than by some headquarters' organization centred in a distant town. The authors referred to this and rightly emphasized the importance of Group industrial gas engineers having ready access to the advice and assistance of large industrial gas centres. There was a need for far more publicity to persuade not only industrial consumers but also appliance manufacturers that industrial gas engineers were available, willing and capable of giving advice on the most efficient use of fuel in industry, and that generally speaking such advice would be given frankly without undue bias in favour of gas.

Recent successes had made Mr. Haynes's Board anxious to increase their industrial staff, but it had been exceedingly difficult to find sufficient trained men for the purpose. There is as yet no grading scheme for industrial gas engineers, and their financial position is uncertain. The Institution of Gas Engineers has, after many years' pressure, developed a course of training and education for the gas salesman, and they are now graded. In view of the results which can be obtained by the properly trained industrial gas engineer, Mr. Haynes suggested that it was high time that the industry took steps to ensure an adequate supply of properly trained and educated industrial gas engineers and salesmen, and to pay them accordingly.

Mr. L. W. Andrew (Manager, Watson House) said that he was very conscious of the peculiar difficulties as well as opportunities which surrounded industrial gas. His attention was drawn to this only too vividly in the early part of the war, when he quite cheerfully went along to convert a very large salt bath, used for treating aeroplane parts, to operate on ½-in. W.G. pressure instead of 2½-in. pressure. On common-sense grounds the problem was not difficult, but the Chief Engineer stood by him and said: 'If as a result of your work production ceases for any period whatsoever, you will go in the salt bath.' He had never forgotten that!

Another factor which has been brought home to him recently was that, in spite of the dirty conditions frequently obtaining in practice, there was a great deal of glamour about the work of the industrial gas engineer. It was not at all unusual for a new applicant for a job at Watson House to ask if he could work in the industrial laboratory. With all due respect to Mr. Patrick, he thought that this was not entirely a question of personality, but of the glamour attached to vast burners consuming enormous quantities of gas, and the excitement of solving problems connected with entirely new processes.

He was full of admiration for the way in which many very difficult problems were handled by the industrial appliance manufacturer and by the research workers and technicians in the gas industry. He was, however, worried that, at times, too much was expected from people on the basis of too little definite scientific evidence. The authors had drawn attention to the fact that frequently it was not possible to make a prototype and test it in the laboratory before it went into the field and the factory. It was, therefore, doubly important that less and less of the design work of the industrial engineer should be based on *ad hoc* experiment and experience and more and more on real fundamental data.

Immense Field for Exploration

There was still an immense field to be explored regarding the fundamental aspects of appliance design. The greater part of the industry's knowledge on the design of almost all types of combustion chamber under natural draught conditions was based largely on experience, and it was necessary to undertake fundamental research on combustion-chamber design as a long-term project. It was equally necessary at all times to be fully informed at the first possible moment of any new types of industrial processes which were coming along and were likely to be important.

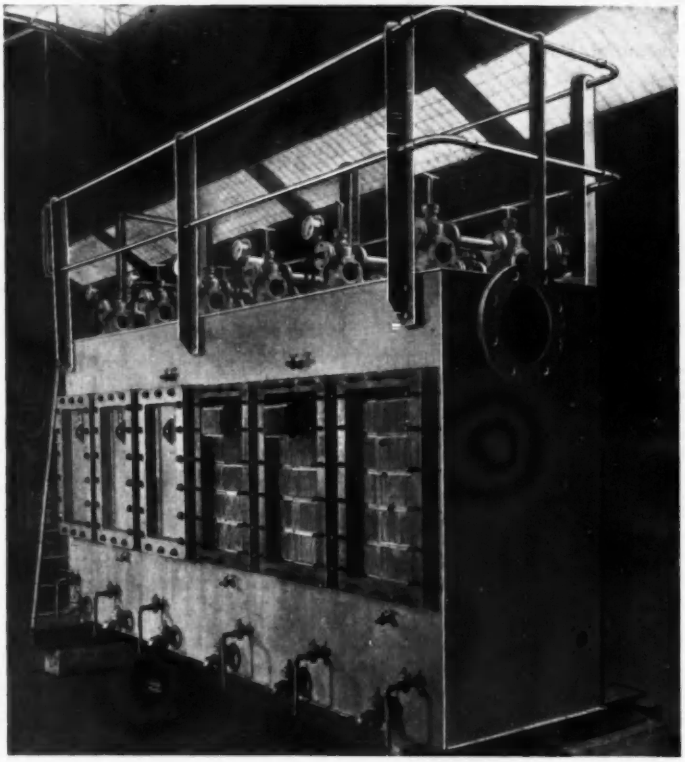
The industry was very familiar with the importance of this and was doing all it could, but it was difficult at times to avoid interference with fundamental research by the day-to-day problems which had to be solved in a hurry. Here again the parallel with domestic appliance research was very close. Examples of the type of work with which many were familiar were flame hardening, the use of combined high frequency cooking with infrared, and the new technique of shell moulding which was becoming popular. It was only by keeping abreast of such developments that not only the user but the manufacturer of industrial equipment could come to the industrial gas engineer with the sure knowledge that he would talk sense when he said that gas would do the job,

Mr. Andrew said that reference was made in the paper to the manufacturer who asked for help too late. As with the domestic side of gas, it was the early contact, which in so many ways was a personal matter, which really made the difference, and he believed that this could only be fostered if the manufacturer knew that any visits would yield positive and real help.

Mr. H. R. Hems (Industrial Gas Officer, West Midlands Gas Board) thought that there was a link between the authors' paper and Mr. Horsfall's. Mr. Horsfall said 'Sell more apparatus and increase the gas load', and he was right. The present authors said 'Get the load, and this will lead to larger sales of furnaces and industrial appliances, and thus further increase the load,' That also was true. Mr. Horsfall dealt with a load which the industry badly wanted and with the reasons for its almost static condition, plus a tendency to fall. The present paper dealt with a load which the industry had fostered considerably but which was also built up from external influences and which was reaching proportions which might upset previously-conceived ideas of the balance between the two loads. Each load was of essential importance to the interests both of the industry and of the fuel economy of the country.

So far as the industrial load was concerned, the paper contained sufficient evidence that we were providing a fuel which was being increasingly demanded by industry, in spite of competition. The already published results of the West Midlands Board showed a 30% increase in this load in the first five years of nationalisation.

To Mr. Hems's mind, the subject-matter of the paper did not quite come up to the scope of its title. The plea to intensify and extend our already-existing advisory service to industry was fully justified, and he strongly supported it. It was valuable to be reminded of some of the pitfalls connected with the heating of tanks and apparatus in surroundings unsatisfactory for good combustion, but he looked askance at forcing a furnace to increase throughput, especially by



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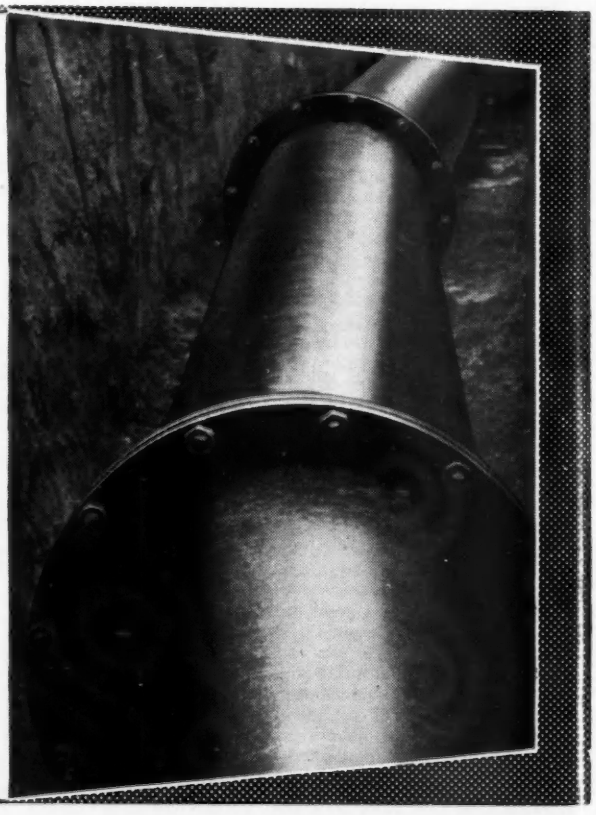

increasing temperature, with the attendant risks of breakdown and the difficulty of temperature control. The authors here touched on an important point which was to the gas industry at once an advantage and a disadvantage, particularly as compared with electrically-heated appliances and furnaces, which were all designed for a rated heat input and generally could not be overworked without disastrous results.

Need for Co-operation

He appreciated the difficulties mentioned by the authors with the consumer who built his own furnace and with certain manufacturers who would not co-operate as the gas industry would like, but they would always exist so long as gas could be applied as readily and easily as it is. However, he had found that persuasion could be applied to improve matters so far as the consumer was concerned.

Probably the greatest difficulty in this connection was in persuading manufacturers of plant requiring flame-failure and other controls to incorporate these in the original specifications and quotations as extras. This was slowly improving. The recommendations of the Factories Department of the Ministry of Labour and the extended work done by the industry through the Industrial Committee had helped considerably in bringing about this desirable change.

For the industry's part in all this Mr. Hems was glad to hear some of Mr. Haynes's comments. He had had the privilege of working with him in past years on some of the developments which had led up to some of the results which they were getting to-day. He was glad to say that his Board, the West Midlands Board, were allowing him to expand his development facilities, to which he attributed after many years of work prior to and since nationalisation, a large part of the industrial load of the West Midlands. He was glad to say, too, that his Board were allowing him to carry out considerable experimental work, to the extent of building, or arranging for building, prototype furnaces without a guarantee of success, which he could not possibly give. He was convinced, however, that the work had to be done, and there he followed the lines which Mr. Andrew had mentioned.

Information Highly Valued

Mr. A. Higgs (Assistant Industrial Gas Officer, West Midlands Gas Board) referred to criticism made in the paper, of the inadequate use by industrial staff of available information; it was also inferred that wider use of such data would enable the industry to provide the necessary consumer service without extra effort in staff or time. If the criticism was made on the basis that full use was not being made of the information contained in Industrial Gas Development reports by industrial staff, then, excepting certain isolated instances, in his experience it was hardly justified. The information was not only used but highly valued.

The authors referred to the wealth of fundamental information available to designers, which information had not been followed up and exploited. It was obviously in the industry's interests that all such academic investigations should be examined and practical results made available to industry as soon as possible. With present commitments, however, he believed the industry's resources in design and practical development staff were not adequate to allow such examinations, and, while such reports were studied, if real benefit was to be gained any necessary development work should be carried out on a planned basis. Often it was a task calling for the services of research and practical development staff, and it might be that still closer liaison between, say, the Gas Council's No. 1 and No. 2 Research Stations and appropriate Board industrial staffs on such problems might be helpful in reaching early conclusions.

Importance of Controls

The authors rightly mentioned the importance of a high standard of construction, layout and installation with flame failure and ignition circuits. Accepting the improved performance of electronic controls from the stability and reliability aspects, all the good work of manufacturers could be nullified by incorrect fitting. This was brought home rather forcibly to Mr. Higgs by a recent explosion in a boiler plant installed by a large and reputable firm of heating engineers. Full electronic and thermostatic controls were fitted, but examination of the plant after the incident established that the ladder bridging pilot was not secured in any way to the main burners, or in relation to the electrode, and moved whenever the pilot gas control tap or the supply was touched. This occasioned nuisance shut-down as the controlled pilot flame moved away from or came in contact with the electrode, but more serious was the fact that the circuit could be electronically complete, and hence the main gas full on, with the pilots out of line and not in a position to light the main burners until an accumulation of gas had occurred.

The testing of industrial equipment had been mentioned. Mr. Higgs supported the view that testing of commercial and small industrial plant should be carried out on a larger scale than at present. If this was done then many of the complaints that arose on consumer's premises would be avoided, and it would contribute, as in the domestic field, to the attainment of a common high standard of efficiency and reliability with less demand on staff time for consumer service.

Mr. W. G. Phillips (Eastern Gas Board) said that the present need for increased production and the shortage of skilled labour had resulted in the adoption of more and more mechanical processes working on line production methods. While the gas industry was well aware of the advantages of town gas in this field, he suggested that it would do well to recognize the fact that this field was likely to be an increasingly competitive one.

He referred to one aspect of this competition, that which arose from the developments that are taking place in electronic heating. High and low frequency and dielectric heating had many advantages in speed, flexibility, control and cleanliness and were capable of producing heat localized where the heating was required. This eliminated the furnace walls and containers of the orthodox type of furnace, whether it was fired by electrical resistors or gas burners, which might consume a considerable proportion of the energy input. As such, this form of heating, in spite of capital and running costs, could be attractive for many processes in the metallurgical and non-metallurgical fields.

Industrial Gas in United States

Reference was made in the report of the gas industry's Productivity Team's visit to the United States in 1952 to the large proportion of gas available there which was being used for industrial purposes, amounting to no less than 53%, its extensive use being due to the low price of natural gas and the fact that the American industrialist was prepared to spend large sums on capital equipment, so making possible extensive mechanization of heat-treatment processes, for which gas was so eminently suitable. Towards the end of last year he read that the President of the American Gas Association, at the industry's Annual Convention, stated that industry in America accounted for one-half of the volume of gas sold in the States and that the biggest competition was coming from electricity; he said that 'It was up to them to keep the kilowatts out by using stronger sales efforts.' The biggest competitor was going to be electricity, notwithstanding the price advantage of natural gas and the availability of oil supplies.

On the subject of development work Mr. Phillips referred to the permeable-lined furnace. Some years ago Anderson, Gunn and Roberts initiated a number of experiments on this type of furnace which showed that material savings in fuel consumption could be effected by the adoption of this principle. In the *Journal of the Institute of Fuel* for January, 1955, there was a paper by Henshilwood and Patrick on further experimental work which has been carried out at Watson House. This work indicated that there was an advantage of approximately 24% in efficiency and in heat transfer as compared with the conventional operation. It was to be hoped that the development of this research work would soon be available for commercial use.

Ahead of Fashion

The author suggested that the gas industry should be five years ahead of the fashion in equipment design. He would most wholeheartedly agree with him and congratulate him on bringing due emphasis to bear on this often forgotten factor. The authors rightly pointed out the favourable psychological effect both on the operatives and the management of attractive equipment having neat and clean lines. In this respect our electrical friends seemed to have gone further than we had. In the range of electric furnaces marketed by one manu-

facturer, that he had in mind, counterbalance weights, chain wheels, etc., to operate the furnace doors, had all been enclosed in the casing, the operation being carried out by a single hand-wheel, the whole effect being most workmanlike.

Authors' Reply

Mr. E. A. K. Patrick (Watson House), replying to the discussion said that the authors would like to thank Mr. Haynes for adding to the paper and carrying it further than the stipulation of the maximum number of words allowed. He said that one of the functions of the industrial gas engineer was to assist in the design of the necessary equipment after the contact had been made. It is not unknown for his first task to be to explain to the industrial consumer exactly what it was that he wanted designed. Applicants for positions at Watson House did seem to have an inclination towards industrial work, and he flattered himself that this was partly due to the fact that the industrial gas engineer had to be a salesman as well.

Both Mr. Andrew and Mr. Higgs spoke of the need for more fundamental work. It all went together; there was need for more fundamental work and there was also a very great need for existing fundamental work to be applied. In that respect a great part of their function was the interpretation and digestion of such fundamental work as had been done, both in the industry and in the universities, and then the production of it for the industrial gas engineer in a form which he could apply. Very much excellent work had lain forgotten because no one had digested it and produced it ready for use. The need for further knowledge, however, was unquestioned. It could be divided into the application of town gas to various industrial processes, of which there were very many. As Mr. Andrews said, the basic need was to study the common factors between all or any industrial and even domestic gas uses.

Natural Draught Appliances

He was very well aware of the need for a fundamental knowledge of the principles governing the design of natural-draught appliances. That need existed largely because so much of the research effort of other industries, of which the steel industry was one, was directed to research on forced-draught appliances, whereas much of their work lay in the natural draught field, which was a very much more difficult one with which to deal.

Mr. Hems, in deploring the forcing of equipment to outputs and temperatures above those for which it was designed, said something with which the authors did not disagree at all. On the other hand, it was a very attractive feature to the user that he could get a little more out of the equipment. He had to be made to realize that he had only himself to blame if he ruined the equipment in the process. It was, he thought, both the strength and the weakness of town gas that it could be used in that manner.

Mr. Higgs spoke of the need for correct installation, which increased with the growing complexity of many industrial installations. Once one left the very simple controls of a simple cock and lighting the burner with a taper—and one had to leave it in present-day conditions—one was forced to use more and more elaborate systems, which had, therefore, to be thoroughly reliable.

Multi-burner Installations

Multi-burner installation was a point of some controversy, Mr. Patrick continued. One of the more difficult tasks in designing gas equipment was the spreading of the heat. There was a certain glamour and reasonableness in releasing the greatest amount of heat from the smallest amount of space, but an equally difficult problem was sometimes to liberate a minimum amount of heat and to spread the heat from the combustion of, say, 10 cu.ft. per hour along a burner 6 ft. in length.

Mr. Phillips spoke of the competitive force of developments such as dielectric heating and Mr. Patrick agreed that dielectric heating could be enormously attractive to the industrialist. However, every now and then they got evidence that, once industrialists had got over this first attraction, they began to find snags. There was more than one instance on record of a return to town gas; maintenance was a frequent ground for this, and running costs with gas could be considerably less. Developments with gas, such as furnace-less heating, had the same virtue as dielectric heating, in that there was no structure to heat.

Mr. Phillips mentioned work on the permeable-lined furnace. Mr. Patrick reminded him that in that work an endeavour was made to set the advantages to be gained from permeable linings in their proper perspective. There were other factors such as the loading of the furnace and the proper control of combustion. In suitable conditions there was an advantage to be expected from permeable operation, but that advantage was no greater than could be gained from proper control of the other circumstances, and that, he thought, was equally important. The work was undertaken with a view to finding out whether permeable linings were suitable and whether the claims made for them were basically sound. He thought that they had shown it, and that it remained for the practical stage of the development to be pursued.

LIGHTING IN BUILDINGS

A revised version of the I.E.S. Code (Code for Lighting in Buildings, the Illuminating Engineering Society, 32, Victoria Street, S.W.1, price 5s.) has just been issued. The forerunner of the Code was first published in 1936 under the title 'Recommended Values of Illumination'; revisions followed in 1937, 1941, and 1942 (the first to be titled 'The I.E.S. Code'). In 1945 a new edition was published which took into account work carried out by H. C. Weston under the ægis of the Industrial Health Research Board and the Illumination Research Committee of the D.S.I.R. This Code was further revised and improved in 1949 and has become widely known and used both in this country and overseas. The International Commission on Illumination at its meeting in Stockholm in 1951 recommended that all countries should study the basis of the British Code when preparing codes of their own; in fact the British Code is widely adopted in other countries. In the 1955 Code the presentation and material has been improved and account has been taken of the data on glare which has been established during the last few years.

The new Code has been written to meet the needs of architects as much as those of lighting engineers. It is hoped that architects will make full use of it and that architectural schools will use it as a basis for teaching. The Code is also intended to help users in formulating their lighting requirements. As the recommendations cover all industries and occupations it is of importance to all who are in any way concerned with lighting whether it be as engineer, architect, factory or office manager, shop or store keeper, etc.; in fact, as no occupation can be carried on without lighting, whether artificial or natural, the Code is of importance to everyone.

A preface to the Code says: 'The statements and recommendations are founded on the general physiology and psychology of vision, and on the applied science of lighting and seeing which has grown out of numerous studies and investigations made in this and other countries, particularly during the past few decades.'

The I.E.E. Code Committee includes members of the staff of the Building Research Station on whose work Part III (Natural Lighting) is largely based. The Chairman of the Committee was Mr. H. C. Weston, Director of the Group for Research in Occupational Optics, Medical Research Council.

The Code is divided into three parts: (I) Light and Sight; (II) Artificial Lighting; and (III) Natural Lighting. It also contains three appendices comprising schedule of recommended values of illumination; list of books and of scientific and technical papers and reports dealing with basic principles and with specific matters dealt with in the Code; and British Standards relating to equipment for the lighting of buildings.

A RESOLUTION calling for action to increase the number of factory inspectors to carry out a greater drive towards prevention of accidents was passed at the conference of the Amalgamated Society of Woodworkers at Blackpool. The conference suggested that penalties for violation of the Factories Act should be increased and that employers should be liable to imprisonment for persistent offences.

Appliance Testing . . . Gas Fitting

By C. WADSWORTH, A.M.I.Mech. E., Assoc. Inst. Gas E and R. L. SCOTT

From a joint paper presented at a meeting of the North of England Section of the Institution of Gas Engineers at Newcastle-on-Tyne on April 21.

IN pre-vesting days small gas undertakings which were unable for any reason to operate their own testing organization were able, by means of an annual contribution to the Watson House Laboratories, to be issued with the test results on all appliances tested at Watson House.

The other undertakings which were able to operate their own laboratories continued in those days to duplicate in part the work which was being carried out in London. But they were more interested in the testing of appliances in use under their purely local conditions and, if necessary, the development of new types of appliances to satisfy the particular need in their area of supply. Since nationalisation the Watson House Laboratories have become the central testing organization of the Gas Council and as such now operate on a fully national basis, issuing their reports on appliances to each area board. In turn the area board laboratories, while still remaining essentially the testing centre for each particular board's area, now tend to spend less time in the duplication of results obtained at the Central Testing Laboratories and concentrate more on testing for the particular requirements of their area, the development of special appliances for particular markets in their area, and finally to some extent to act as field laboratories to the central organization. In this capacity the area laboratories fulfil a very useful function and close liaison is maintained with the Central Laboratories by means of several national committees which meet periodically. On these sit members of the various board organizations and members of the Central Testing Laboratories. One such committee is the Technical Committee of the Watson House Centre.

Efficiency and Safety

All appliances which are to be put on sale by the gas boards and into the hands of the general public should be of the highest possible standard both from the point of view of efficiency, effectiveness and durability and it is the aim of the appliance testing laboratories to ensure that these conditions are fulfilled. To this end all new appliances developed by the manufacturers are submitted for test to the laboratories and here are subjected to the most searching tests which we are able to devise. A new appliance arriving in the laboratory for test is looked at technically under roughly five headings: (1) Safety, (2) effectiveness, (3) efficiency, (4) durability, (5) ease of installation, adjustment and maintenance.

It is appreciated that under certain circumstances when combustion of the fuel takes place, toxic substances can be produced in the production of combustion. The products of combustion are normally, of course, non-toxic. It is, therefore, necessary with each new appliance to impose stringent tests for gas soundness and also for completeness of combustion. These tests are carried out, in the case of gas soundness, at substantially higher pressures than would normally be encountered on the district. Combustion testing is carried out at both the normal rating of the appliances (i.e., makers stated rating), and also under overload conditions, where the combustion must still be satisfactory when the appliance is tested at an increase of some 40% by volume over the maker's stated rating. Tests are made to ensure that the appliance does not become over heated. Further tests are carried out to ensure that the floor and walls against which the appliance will be installed shall not reach a sufficiently high temperature as to become a fire hazard.

Effectiveness

Under this heading come all the functional tests which are applied to the various appliances. In the case of a gas cooker, tests are at various temperatures and on many types of food, from small scones and queen cakes to large rich fruit cakes and a full dinner test. The failure of a cooker to cook any one item will result in the rejection of that appliance until the particular test can be satisfied. Furthermore, the cleaning aspect is also investigated to ensure that the equipment under test will fairly readily be kept clean.

Having established that the appliance fulfils its designed function we must now ensure that it does this efficiently. An instantaneous water heater is tested for overall efficiency by carefully measuring under controlled conditions the heat input to the appliance and the heat output as usable hot water from the appliance. Similarly the boiling burner of a gas cooker is tested to find the time required to raise a given quantity of water through a given temperature and from this figure, noting the heat input to the burner, we can calculate the efficiency of that particular burner under working conditions. In the case of the flued gas fire we are able to measure the useful heat available for warming the premises in which the fire is installed. Conversely we can measure the heat loss to the flue with which the appliance is connected and here again we are able to arrive at an accurate measure of the efficiency of the appliance.

Reasonable Useful Life

A further and quite natural requirement of all domestic equipment is that it should have a reasonable useful life and in this respect tests are carried out on the finishes and the materials from which the appliance is manufactured. Life tests also attempt to reproduce under laboratory conditions the behaviour of equipment in prolonged use in consumer's premises. Thus we are able to determine scientifically whether a finish on any particular appliance or part of an appliance is sufficiently durable to ensure a reasonable and trouble-free life when installed. One noteworthy example of this is the improvement in resistance to acid and alkali attack of the vitreous enamels in use today in the finish of domestic gas appliances. Finally, when an appliance has satisfied all these requirements, it is examined mechanically with the object of establishing that when put into use and into the hands of the fitting and maintenance staffs of the undertaking, it should be relatively easy to instal and adjust. Should trouble develop at some time in the future the appliance should be easily dismantled with the working parts readily accessible for maintenance to be carried out on them. These tests are, in most cases, laid down in British Standards, of which a great number are necessary to cover the complete range of tests.

The testing of appliances is not a static function but is constantly being adjusted and modified to take into account the varying conditions which occur as a result of increased knowledge of the basic requirement for any type of appliance and also due to changes in design. It will be readily seen that a completely new idea incorporated in a domestic appliance may not be covered by existing standard tests and freedom must exist for the testing authorities to devise new tests to cope with new conditions. As a result of this fluidity the current standards are considerably higher than those obtaining some 20 years ago and have resulted in 'improvement of the breed' of appliances.

The whole of my description of testing has been concerned with purely laboratory tests and it is my feeling that the laboratory test in itself is not the final answer to the success or failure of any particular appliance. The final test of an appliance's success lies on the district where it is installed. More and more today, district tests on small or large scale are being carried out on all types of appliances. The combination of the laboratory test followed by district test under controlled circumstances is, in my opinion, the complete answer to the provision of entirely satisfactory domestic appliances.

In the day-to-day life of the gas industry it frequently becomes apparent that a special requirement obtains in an area

for a particular type of appliance to fulfil a definite local need. Thus we have an idea which may ultimately become the basis for a new appliance design. The original thought for a new design can spring from almost any source—a district representative chatting to a consumer, a sales manager looking for a new gas load or a bright idea in the mind of a member of the laboratory staff. The new idea finds its way into the laboratories usually with a request from say, the sales force, to look into the matter, and in due course several suggested prototypes can be produced each of which fulfils the technical requirement of the original idea but possibly carrying out the fulfilment in different ways. It is then necessary for the prototype appliance to be inspected and considered by as wide a range of people as possible and the opinions of each carefully examined. From this concensus of opinion further prototypes can be produced until finally something approaching an agreed pattern can be obtained. From here the work is primarily development and development normally proceeds hand in hand with the appliance manufacturer who assists in the production of the appliance based on the original prototype but developed with the idea of quantity production in mind. Two such appliances which have originated from the laboratories of the Northern Gas Board are the 'Northern' sink water heater and the 'Bamburgh' convector gas fire. Both these appliances started as the result of original ideas by members of the Board's staff, were partially developed and tested in the Board's laboratories and finally the development was completed by the manufacturers concerned. It has thus been found possible to produce two new appliances for specific local markets which we now find becoming more generally acceptable in the national markets. It cannot be stressed too fully that water-tight division of departments is not possible if effective progress is to be made in the development of improved appliances. It is my opinion that members of a testing organization should have had some training on the district in order that they may fully appreciate the requirements of all concerned with the utilization of gas appliances. One important aspect of this is the handling of complaints and it is the policy of the Northern Gas Board that complaints which appear to be unusual in some respect can be handled, if necessary, by members of the laboratory staff. This contact with the public also informs the technical staff of troubles occurring on the area at an early stage and in many instances provides evidence for manufacturers of possible manufacturing defects which are occurring in their works without their knowledge. It also provides useful information for the compiling of statistical reports of the incidence of complaints which further assists makers when considering new designs for future production, and from which weaknesses of previous models can be eliminated.

GAS FITTING IN THE TYNESIDE DIVISION

Gas fitting today is a craft which over recent years, from the craftsman's point of view, has become more interesting and more exacting than ever before due to the high grade type of appliances embodying many improved fitments and labour saving devices.

The following data refers only to the Market Street section of the Tyneside Division; a section which employs 116 plumbers engaged on installation and appliance fixing, 31 apprentices in various stages of tuition and 90 handymen who deal with appliance maintenance and straight exchanges of cookers and meters. These men are under the control of two chief inspectors and ten district inspectors.

It has always been the practice to equip the men for their work with the appropriate tools and in this connection discussions take place from time to time with inspectors and workmen who are given samples to test on their own particular jobs, the results being reported and then acted upon. In addition to these discussions suggestions are also dealt with by the joint consultative committees. You will see in the room along with photographs a typical kit of tools as supplied to the men. These are checked periodically and replacements are made against fair wear and tear.

Every effort is made to demonstrate as many of the new appliances and fittings as possible by taking a small number of men at a time into the instructional centre where the appliances are dismantled and the men themselves re-erect them. It is most important that the district maintenance men understand all major appliances except water heaters, as it is they who must attend to their servicing.

The building trades on the large estates work on a bonus system which necessitates a quick follow up by the plumber, otherwise he finds floors boards down or electric or water installations in the runs he had selected. The following method has also proved very successful. During the laying of the concrete rafts the contractor places a 2 in. × 2 in. spar to the required points on base with a fall towards the meter position and when the final level of the concrete is made up and while still green the spars are removed thereby allowing the plumber to lay his ½ in. wrapped pipe in the chase. At the lowest point and adjacent to the meter a square hole is left in the concrete base for the fixing of a draining point, alternatively the pipe is carried directly through the outside wall with a flush fitting plug on the outside.

Concerning such appliances as gas-fired coke grates, it was suggested to the local authorities that a much neater job of work would be for the makers of the tiled hearth to leave a hole through the hearth some 2 in. to the side of the grate; in this way an unsightly run of brass tubing is eliminated. With high grade cookers, whether they be in new houses or are replacements for an older type, it is the practice to fit a floor plate and a straight length of ½ in. copper to the cooker. This obviously does not apply on an exchange cooker if the supply pipe is brought down from ceiling level. In this particular unit 3,500 houses have been completed during the past year bringing the total of completed post-war houses to 30,000. In addition to the meters and appliances in the above houses 1,100 meters, 5,500 cookers, 6,147 water heaters and 6,000 fires have been installed by Board workmen during the past 12 months in addition to which the local master-plumbers, who are most co-operative, have installed in the same period on behalf of the Board 2,300 water heaters, 1,800 fires and 950 cookers.

In the case of the private plumbers' jobs, each installation is examined on completion, and has to be passed as satisfactory before payment is made. Also, in order to keep them fully informed as to new appliances and to discuss methods of fixing and adjustments, they are invited to the educational centre where these matters are explained.

Thought was given to the actual transportation of cookers, fires, etc., over the districts and after numerous discussions both with the men who have to handle them and the transport department, a new type of vehicle was built to the Board's specification. With its many advantages it has justified its purchase. You will see that it is of the low loading type with shutter doors on the back and sides, thereby simplifying the handling and so arranged as to eliminate the need to move any one cooker to reach another. Unlike those in the photograph each cooker is covered and strapped independently thus avoiding movement or damage when the vehicle is negotiating corners or braking in an emergency.

Full advantage has been taken of the height and length; W.I. and copper pipes in long lengths are carried on shelves which pass over the driver's cab which has been provided with a protective plate to prevent damage to the metal covering. Also on the overhead shelves is space for water heaters, fires, etc. Another advantage is the fact that with a centre aisle, electrically lighted and being completely covered in, the driver is able to select any appliance rather than make his calls in accordance with the position of the appliances.

In a further endeavour to minimize damage complaints, an enamels inspector carries out a spot check on all consignments of appliances on arrival at the stores of the distribution centre and through his findings manufacturers have improved their transport facilities, and methods of wrapping. Information gathered regarding minor faults are reported to the laboratory whose personnel in turn discuss the matter with manufacturers and the defects are usually corrected.

This inspector also deals with consumer complaints on damaged apparatus, and submits a weekly return setting out the type of appliance, description of affected parts, and, in his opinion, the cause of the damage. If any particular fault recurs this information is also forwarded to the laboratory for

attention. Full examination of complete consignments takes place periodically, in addition to the spot check already mentioned; a report of which is sent to the Watson House Enamels Committee.

Cooker exchanges of the older cast iron type fitted to prepayment installations is carried out on a bonus system agreed between management and workers which was aimed at increasing the output per day, in order to reduce costs and at the same time benefit the worker. The scheme which has been in operation for some time now has proved most successful, very little supervision being needed; the handyman and the driver leave the despatch department promptly and do not return until their load of cookers has been fixed.

During the course of each year a squad of handymen deal with maintenance of appliances in post-war council houses; cleaning, adjusting and replacing worn or damaged parts which may be necessary.

In addition to this service a pre-heating season check up of all domestic central heating boilers is carried out and again replacements are made with the consumer's consent where necessary. It has been proved that this maintenance call minimizes complaints during the heating season, complaints which, however small, are serious to the consumer when the whole system could be out of operation when most needed.

Realizing the importance of the water heating load and the necessity for fully qualified plumbers to attend to it, a team of ten men was established to deal solely with complaints and these men carry out an all year service of 'on demand' calls, each man dealing with his own particular area which gives him the advantage of knowing what appliance is likely to confront him. A complete record is kept of these complaints and if there appears to be a frequent recurrence an inspector is called in to assist in diagnosing the trouble.

A most important innovation to this Division was the installation in 1952 of a radio telecommunication system which, from a control centre, directs the movements of seven radio controlled vans within a radius of 20 miles. Vans can be directed to emergency jobs and quite apart from the infinitely speedier arrival at their destination they have also reduced the amount of overtime in the outlying districts due to the fact that the handymen who cover these districts during daytime, telephone the distribution centre frequently during each day to receive any escapes or complaints in their particular sector and it may be that on their last telephone call at 3.45 p.m. they could be given a number of jobs which may quite possibly take them up to 8.0 p.m. to complete, whereas with the radio the majority of this work—*i.e.*, escapes or special emergencies—is passed directly from control to the nearest van in the locality. Other normal faults being dealt with by the district workman.

In the case of any serious outside escapes one or more vans can be directed to the site within minutes and the speed with which a mains gang can be brought to a job has probably prevented accidents which may have been serious.

DISCUSSION

Mr. W. R. Garrett, Chairman, opening the discussion, asked if the 'Bamburgh' fire and 'Northern' water heater were subject to the same testing at Watson House as other appliances. He also asked how long it usually took for an appliance to be proved or considered. The closing tops on many of the recently available cookers were, in his opinion, of little use. Why, he asked, had these been incorporated when no doubt they raised the selling price. Some coke appliances became blocked with fine ash and needed attention, concluded Mr. Garrett.

Mr. Wadsworth, in reply, said the 'Bamburgh' and the 'Northern' had been submitted for test to Watson House just as any other appliance directly conceived by manufacturers. While the appliances had been conceived by members of the staff of the Northern Gas Board, they had been produced by appliance manufacturers. The time taken for approval of an appliance depended on whether many or major modifications were necessary. The idea of folding tops for cookers had originally been a sales point. No models were at present produced with them. The very high ash content of available coke was to blame for the faulty operation of coke burning appliances.

Mr. G. E. Haddon, Stockton, spoke of the adverse publicity resulting from explosions in gas cookers. He felt that incorporation of some automatic device was necessary.

Mr. Wadsworth agreed and pointed out that cookers with complete automatic lighting to all burners were now on the market. From a technical aspect, gas cookers could easily be made safer. It was the question of producing them at competitive prices. This was, of course, receiving urgent attention. Mr. Wadsworth continued that he preferred automatic lighting of burners to safety cut-off adaptations. He also referred to the great number of older type cookers which would remain in use for many years to come.

Mr. J. E. McManus, Wallsend, asked at what pressure tests were carried out on appliances.

Mr. Wadsworth stated that for combustion testing, 100% pressure overload on the makers' rating was the usual figure for ungoverned appliances and 50% pressure overload for governed appliances; thus ungoverned appliances designed for operation at 2½ in. W.G. pressure were tested at 5 in. W.G. which resulted in a 40% volume increase. Complete appliances were pressure tested for gas soundness at 12 in. W.G. and gas cookers and their fittings at 100 in. W.G.

Mr. W. R. Garrett, opening the second part of the discussion, referred to the replacement of tools for fair wear and tear and presumed that loss of and careless damage to tools involved the employees in the cost of replacement. From experience in other connections, he wondered whether the turnover of labour in Mr. Scott's department was high. Referring to the suggested duct in the hearth of fireplaces for accommodating the gas service for automatic lighting, he asked whether such fire-places were available. The idea of appliance covers to prevent damage seemed to be good. The financial advantage gained would be fully dependent on the life of the covers. What was the life expected to be? Mr. Garrett said he felt that with iron piping it was necessary that a gas of low oxygen content should be supplied.

Mr. Scott replied that fair wear and tear was the only accepted criterion for the replacement of tools. With reference to changeover of labour, this was very low and had only been some six in the past year or so. These were principally attributable to retirement or leaving the area. Tiled hearths, said Mr. Scott, could easily be supplied with ducts and usually any supplier, when manufacturing a fire-place, would provide the hole required for the gas supply. The appliance covers referred to were expected to have a life of five years and on this basis would prove infinitely cheaper than re-wrapping appliances before delivery to the consumer.

Mr. K. E. B. Brown, Newcastle, mentioned the Chairman's reference to the effect of oxygen on iron pipework and said he considered that an internal red lead coating, which had been used successfully in his undertaking for the past 25 years, was very important. He agreed too, that oxygen should be kept to a minimum. Where work undertaken by private plumbers and work undertaken in bonus schemes were concerned, Mr. Brown felt that subsequent testing was necessary in order to make sure that proper care was given to each installation.

Mr. Scott maintained that in the case of complete pipework, testing was always carried out to make sure that faulty work did not go undiscovered. After the simple fitting of a cooker, however, testing did not always take place, although the work was always inspected by district inspectors with a view to seeing that it had been done properly.

Mr. Haddon preferred the designation gasfitters to that of plumbers. He said he had recently had some experience of using private plumbers for gasfitting work and felt that while their standards were generally reasonable, they were not as good as his own gasfitters who had been trained specially for a particular type of job.

Mr. Scott replied that private plumbers who undertook work were very much in the same category as employees and that some did better work than others. Any who did faulty work were subsequently left out of the scheme.

Mr. J. E. McManus, Wallsend, questioned the use of iron pipe and felt that if any resultant rust caused subsequent attention to appliances, any saving in cost might easily be offset, or more than offset, by subsequent visits and servicing. He also felt that all work undertaken should be pressure tested to make sure that it was safe.

Mr. Scott said experience had proved that any attention to appliances resulting from the use of iron pipe had not offset the initial saving.

Mr. W. R. H. Lorimer, Alnwick, proposed a vote of thanks to the authors.

South Western Gas Prices Increased

Gas prices in the South West will go up on June 27, for the first time in over three years. The average rise of 2.95d. per therm will mean an extra 8d. a week to the average domestic consumer. A full explanation of the causes of the increase was given by Mr. C. H. Chester, C.B.E., Chairman of the South Western Gas Board, to the Gas Consultative Council at a special meeting at Taunton on June 15. The Chairman (Alderman A. W. Loveys) mentioned that the 17 days railway strike had cost the Board about £34,000 in maintaining full supplies.

Mr. Chester said the Board had now been forced by rising prices to increase gas charges. Since the price was last increased in the South West, on June 1, 1952, increases in the prices of coal, wages, salaries, and all other materials and services had amounted to over £1 mill. per annum, but the Board had materially mitigated the effect of these increased costs and so avoided passing them on to gas consumers.

This had been made possible by greater technical efficiency, by closing down a number of small and relatively inefficient gasworks and supplying those districts from larger, more efficient undertakings (20 were closed down in 1954-55, including those at Trowbridge, Newton Abbot, and Dursley), by taking steps to ensure the utmost economy in all its operations, by increasing the output per man (over 1,000 less employees at March 31, 1955, than at March 31, 1952) and by increasing the sales of gas, coke, and gas appliances.

Over 37,000 gas cookers were sold in 1954-55, making a total of nearly a quarter of a million since 1949, and in 1954-55 the number of water heaters installed increased by 25% over the previous year, reaching the record figure of 37,151. Further increases in costs, which the Board could not hope to absorb by greater efficiency, were estimated to amount to £927,000 in a full year. To meet these costs, and to provide a buffer towards expected further increases in costs, the price of gas was to be increased by an average of 2.95d. per therm (about 15%).

Tariffs Still Promotional

The revised tariffs, both domestic and non-domestic, had been designed to encourage the use of gas, both in the home and in the shop or factory, by reducing the price in progressive blocks as the consumption of gas increased. The effect of the new tariffs would be to cost the average domestic consumer an extra 8d. per week, and the Board claimed that this was a very reasonable amount, bearing in mind that it was the first increase for over three years, during which time the costs of nearly all other commodities (including gas supplied by all the other gas boards) had increased, and that during the three years to October, 1954, the average weekly earnings of all workers had increased by 22%.

Mr. Chester pointed out that during the three years for which the Board had kept the price of gas steady the increases which had occurred in other commodities had been as follows:—Domestic electricity in the South West (to a consumer of 1,000 units per quarter in a 5/8 roomed house), 10¼d. a week, or 12%; household coal, Grade IV, in Bath, 19s. 6d. per ton, or 16¼%; rent and rates (cost of living index), 14%; fuel and light (cost of living index), 15%. Gas prices were being increased by an average of 15% over 1952 prices, and this compared very favourably with the figures given, most of which were likely to increase again in the near future.

New Standing Charge

There were some small consumers who were not contributing their proper share of the cost associated with making the supply of gas available, and to meet the position to a certain extent the Board had introduced a quarterly standing charge for domestic consumers of 3s. for ordinary consumers and 3s. 9d. for prepayment consumers. This charge would be payable irrespective of the quantity of gas which had been consumed, and the separate charges for primary domestic meters would be abolished.

The 'constant demand' tariff which was introduced in September, 1952, to meet the needs of industry had proved so successful that the Board had decided to make it available to consumers of not less than 500 therms per quarter and this, it was felt, would lead to even greater increases in the use of gas for industrial purposes.

Pointing out that the south west was very remote from the main coalfields, Mr. Chester said that while the average increase in the cost of rail-borne coal to the gas industry, resulting from the recent rise of 7½% in rail freight charges, was about 1s. 6d. a ton, the figure for the South Western Board was about 2s. 6d. a ton. He was providing a sum for a much needed reserve, but if an exceptional increase occurred in the cost of coal at the pithead they might have to look at their gas prices again.

It was expected that an agreement would soon be reached on a pension fund for the Board's manual employees. A provisional estimate was that it would cost £50,000 in 1955-56 and £100,000 in a full year.

Mr. Chester said the results of the Board's year just ended were not available. It did not expect to make a measurable surplus nor a substantial loss, but 'just a small profit.'

The present increase in prices was estimated to produce £880,000 in 1955-56 and £1,410,000 in a full year, leaving an estimated balance at the end of this year of £132,000, and next year £608,000 if costs did not rise again. The present reserve fund of £50,000 was much too small, having regard to their annual turnover of about £17 mill. and fluctuating costs.

Mr. R. L. Liney (Teignmouth) congratulated the Board on having held down the price of gas for so long. He said that the increase was applied as equitably as possible to all classes of consumers. He thought, however, that the standing charge of 3s. 9d. a quarter, instead of the primary meter rent, would hit small consumers, including old age pensioners.

Mr. Chester said the standing charge would not cost anybody more, except those who paid nothing now. At present over 500,000 consumers were subsidising about 66,000.

Mrs. E. J. Exelby (Redruth) said that the people who were now 'getting away with it' included those who simply used a gas ring at the office or at home in an emergency, such as when the electricity failed.

Mr. G. W. Powell (Stroud) said there was sometimes a feeling of frustration when the Council was presented with a *fait accompli*, as in this case.

The Chairman said that the Council must have an 'unanswerable case,' showing that the Board had made a mistake, in order to appeal to the Minister against the new tariffs.

Mr. Chester said the Board had not received any representations from the Consultative Council about the principles on which gas charges were based.

The Chairman said the Board had adopted some of the suggestions made by the Council's Tariffs Sub-committee, which represented the different classes of consumers.

Miss J. Stephen (Deputy Chairman), a member of the Tariffs Sub-committee, said they had to face economic reality.

Several members expressed appreciation of the services of the Tariffs Sub-committee.

The Council unanimously accepted the proposed new charges.

Segas Plant for Germany

The Power-Gas Corporation, Ltd., reports that its German licensee, Didier-Kogag-Henselmann G.m.b.H., Essen, has received an order for the installation of an 850,000 cu.ft. per day 'Segas' catalytic oil-gas process plant for the gasworks at Hamelin, Germany. The process is designed to produce from a varied range of oils a gas with calorific value, specific gravity, and combustion characteristics similar to those of town gas. The gas produced is, in fact, interchangeable with town gas.

The plant to be erected in Germany will be cracking heavy grades of oil, and is due to go into operation before the end of the year. The process is capable of reforming liquefied petroleum gases equally well, and the plant can be used for heavy base load or peak load requirements.

Telektron (Great Britain), Ltd., industrial control engineers, advise us that they have moved into new offices at: Eagle House, 109, Jermyn Street, London, S.W.1.

Mr. J. R. W. Alexander on Industrial Relations

MR. J. R. W. ALEXANDER, C.B.E., former Secretary of the Institution of Gas Engineers, Past President of the Chartered Institute of Secretaries, President of the Institute of Arbitrators, and Executive Chairman of the Gas Officers Guild, gave a comprehensive review of 'Industrial Relations' in a paper at the annual conference of the Chartered Institute of Secretaries at Folkestone last month.

In view of the increasing need for the avoidance or settlement of disputes without recourse to strike action or lock-out, he said, conciliation, arbitration and enquiry facilities have been made available by the Conciliation Act, 1896, the Industrial Courts Act, 1919, and the Industrial Disputes Order, 1951, for the determination of differences which cannot be resolved by the parties themselves, or under machinery established by them.

For 80 years the State has recognized the settlement of wages and working conditions by a bargain in the form of an agreement between employers (or associations of employers) and workpeople's organizations. Such collective negotiation and compromise rests upon the principle of mutual consent. Of all workers in the industries and services of Great Britain, about 80% are covered by voluntary joint negotiating machinery, or by statutory wage regulation in trades or industries where organization is inadequate on one or both sides. There are now 130 Joint Industrial Councils and 65 Wages Councils, the latter covering (in 1953) 490,877 establishments.

Three authoritative statements, made in January, 1954, have become increasingly significant by reason of the spate of threat of strike action to which the country has since been subjected. First, the Prime Minister (then Sir Winston Churchill) refused to introduce legislation which would make strikes illegal until such time as a secret ballot of the workers, under Government auspices, has been taken. The Trade Union movement, he said, is to be left to manage its own affairs. Second, the Minister of Labour and National Service (Sir Walter Monckton) reaffirmed that the Government does not issue instructions, or guidance of any sort, to arbitration tribunals regarding the level of wage increases they should award. The Government scrupulously respects their independence, he declared, and there would be no tampering with arbitration. Third, the Permanent Secretary to the Ministry of Labour (Sir Godfrey Ince) observed that all wages and conditions should be settled by joint voluntary negotiation and all disputes determined by constitutional machinery, which should provide for finality by way of arbitration.

Any attempt to make strikes illegal would arouse, rather than allay, political and industrial strife. The withdrawal of labour, however, is not justifiable and may be unlawful, if a contract of service or other agreement is not observed, or if established negotiation, conciliation and arbitration processes are ignored. It follows that any strike called in defiance of such contracts, agreements or processes constitutes a challenge which should be met and that the public and the Press should support the determination of an employers' organization or a trade union to remain firm in the face of intimidation and duress. But it should not be overlooked that, during the early days of a difference, the Ministry of Labour must necessarily act with caution. It has to be independent and impartial, as between the parties, in utilizing the comprehensive conciliation, arbitral, and enquiry resources at its disposal for the avoidance or settlement of disputes.

Nevertheless, the need for public information and guidance remains and the consequential burden which falls on the Press is a heavy and onerous one. Generally, the industrial dispute is complex and the facts difficult to ascertain and condense. There is a reluctance to say anything which might prejudice settlement. When the issues are resolved, the dispute ceases to be 'news.' In any event, there is a disposition to avoid review of what transpired and its lessons, in order not to antagonize either party.

The need for publication of the facts and the expression of opinion is particularly marked when strike action is unofficial or quasi-unofficial, when it has subversive origins, when it is improperly directed against selected employers, when it is conducted on the basis of sabotage or guerilla tactics, or when it involves public services.

Reluctance to Arbitrate

Joint voluntary negotiating machinery should not be regarded as complete if it does not provide for arbitration in the event of the parties being unable to reach agreement. Moreover, in such event, the parties must be ready and willing to go to arbitration at once. In fact, certain trade unions are increasingly reluctant to implement such provisions or to agree to arbitrate in their absence. They have gone so far as to refuse to appear before a tribunal to which the dispute has been referred by the Minister for settlement.

Sometimes the employer doubts if the arbitration tribunal can be made to understand the circumstances of his case, which he always regards as exceptional. He believes that the award will merely 'split the difference' between claim and offer. Much more intractable, however, is the reluctance of the trade union official who dislikes calling in a third party to determine matters which he (the official) considers he alone should settle. He believes that recourse to arbitration reflects on his capacity and will not earn the requisite measure of commendation from his members.

If it could be generally and genuinely recognized that arbitration is the natural and logical means of settling disputes which the parties themselves have been unable to resolve, the nation would be spared much of the ill-effects of industrial strife. Impartial and adequate machinery is freely available; if it is voluntarily adopted, it would be unecessary to consider the adoption of additional powers of compulsion. Impetus to the movement would be given if workers, called on to decide between a strike or arbitration, were able to record their votes by secret ballot instead of by a show of hands in open meeting.

Strike Statistics

The material losses which derive from strike action, and the extent to which they are increasing, may be gauged from the statistics issued by the Ministry of Labour and National Service. In considering them over the years it should be remembered that, instead of involving large numbers of workers for relatively long periods, the sinister strike technique has been developed of calling-out only men in key occupations; of discriminatory action against individual employers; of restricted working falling short of a complete withdrawal of labour; and of the lightning strike of short duration, preferably one which occasions public hardship. Above all, the unofficial use of the strike weapon is increasing, and is encouraged if strike leaders are in a position safely to anticipate that their union will be content to let the stoppage proceed and most certainly will not take disciplinary action against them.

Stoppages of work arising from industrial disputes in the United Kingdom resulted in an average yearly number of working days lost, during the period 1914 to 1918, of about 5,360,000. This rose to an average of 49,140,000 during the three following years. From 1922 to 1932 (omitting 1926 when 162 mill. days were lost, largely in the coal-mining dispute and general strike) the yearly average loss amounted to about 7,560,000 days. During the 20 years from 1935 to 1954, the annual average was about 1,983,000. The minimum number of days lost was 940,000 in 1940, with maxima of 3,714,000 in 1944, 2,835,000 in 1945 and 2,470,000 in 1954.

The number of workers directly and indirectly involved was 279,000 in 1935 (the minimum) and 447,000 in 1954, the maxima being 826,000 in 1944 and 1,374,000 in 1953. The number of stoppages begun was 553 in 1935 and 1,994 in 1954, when the stoppages exceeded those of any year since 1935, except for the war years of 1944, 1945 and 1946, the maximum being 2,205,000 in 1945.

Statistics demonstrate that the figures were higher in 1954 than in any year since 1946 in respect of the number of stoppages; since 1947 (except 1953) as to the number of workers involved; and since 1945 in working days lost. Analysis of the 1954 figures reveals that of the 1,994 stoppages which began in the year, 1,468 were in coal-mining, 125

in transport, 75 in building and contracting and 62 in shipbuilding and ship repairing, leaving only 264 stoppages in all other industrial groups.

Of the 447,000 workers involved, the respective figures in these four industries were 204,400; 110,400; 36,600; and 16,000. Of the total number of days lost (2,470,000), 470,000 were lost in coalmining; 930,000 in transport; 233,000 in building and contracting; and 522,000 in shipbuilding and ship repairing. Only 315,000 days were lost in all other industries.

Unofficial Action

Leaders of the Trades Union Congress and of the great trade unions have been taking an increasingly realistic attitude towards the overall damage done by the unofficial strike. Recently, the T.U.C. has played a notable part in resolving stoppages. Mr. Tom O'Brien, M.P., Vice-Chairman of the T.U.C., has said that 'in former days it was hostile Governments and hostile employers who raved against the right to strike. Today it is those workers who allow themselves to be duped by the pedlars and cheapjacks of phoney trade unionism who will destroy this basic right to strike. Continuous and contemptuous disregard by sections of workers of solemn agreements and of their unions' executive authority is bound to invite sooner or later the introduction of repressive legislation to prevent such conduct.'

By its unwarranted persistence, its disregard of obligation, its unfair discrimination and its subversive intent, the irresponsible strike of today is a Cold Strike. It is comparable in its origin and conduct, in the injury it inflicts and the disruption it creates, with the Cold War and is almost as abhorrent. The challenge has to be met, ideologically and technically, for—to quote from President Calvin Coolidge's telegram of 1919—'there is no right to strike against the public safety, by anybody, anywhere, any time.'

Coolidge could not have foreseen that the time would come when the public would be imperilled by strikes to determine a dispute within a union, or between one union and another, or that unions would fail to deal with unofficial strikes by disciplinary action against those of their members who were defying their authority and breaking service agreements.

Professional staffs generally are not without representative organizations. Indeed, in the nationalised industries and the health and local government services, for example, much progress has been made and in the right spirit of joint negotiation.

Differentials

Increases in wages brought about by flat-rate (as distinct from percentage) general increases and cost of living bonuses are among the factors which have contributed to the reduction of the substanial differential which at one time obtained as between the skilled and unskilled worker. Realistic differentials encourage initiative and contentment among those from whom particular responsibility or effort is required and they stimulate the worker to train for and apply himself to securing promotion.

The narrowing of differentials presents one of the most intractable problems in industrial relations. Among professional staffs it is making the recruitment of qualified staffs, especially senior officers, extremely difficult. This should not be so in an age when administrative, scientific, and technical men and women are essential to the increased output of better products at competitive prices.

The unskilled worker, however, is in a position to 'call the tune' by reason of his superior numbers. The amount he is paid is not determined by evaluation of the work, but by a number of fortuitous considerations. He secures more, for example, if he is in a 'closed shop,' which enables him to create an artificial shortage of labour; if he is engaged in a seasonal or perishable trade, when sudden strike action or restricted working becomes an additional powerful weapon; if the individual employer is not adequately represented, or is unable to cope with the experience, resources and skill of the trade union; or if that union takes every opportunity of using its strength to the utmost and without regard to the desirability of securing a just relationship between the wages of different classes of workers.

Restrictive Practices

Considerable and sustained ingenuity has been given to the devising and extension of restrictive practices by the worker, as distinct from the agreement of reasonable conditions of employment designed to avoid his exploitation and to ensure a fair week's wage for a fair week's work. Between the wars restrictive practices were used, understandably but erroneously, to increase employment. The scope of a man's work was narrowly defined; his job was split and split again into artificially separate operations; and other means were found to create more and more jobs by lowering individual output. In practice, the outcome frequently was that there were fewer jobs.

While it is not easy to 'put the clock back,' the fact is that, despite the entirely different conditions of today, with full employment and social security, restrictive practices have not only been maintained but extended. In the face of the transfer from a sellers' to a buyers' market, supply being in excess of demand, and of intensified competition from countries newly industrialized or recovering from the effects of war, both employers and employees must examine the position with a view to reducing the wastage, irritation and demoralization which restrictive practices occasion.

The Whitley 'Committee on Relations between Employers and Employed' was set up nearly 40 years ago in conditions entirely different from those which obtain today. The machinery of negotiation, conciliation, arbitration and enquiry which it encouraged has served the nation well. But the time has come for an exhaustive review of industrial relations as they exist today to ascertain what modifications are needed.

There can hardly be a responsible person in the country who would not agree that all is not well with the relationship between employer and employee, or with the machinery available to settle, by agreement or arbitration, the terms and conditions of employment. The issue is as important and urgent as the hydrogen bomb, housing, or any aspect of foreign or domestic policy. Efforts should be made to strengthen the trade union movement in general and the Trades Union Congress in particular and to foster their co-operation with the Government and with associations of employers. Inhibitions on either side are outmoded and unrealistic, for representative organized labour constitutes an estate of the realm, any criticism of which is intended constructively to assist in the removal of shortcomings.

Although in any discussion of industrial relations it is difficult to avoid creating the impression that the culprit is the trade union, the fact is that employers must accept their full share of responsibility for the present situation, which might have been less grave had they made a more definite attempt to master the philosophy and technique of industrial relations.

Six Employees of the Scottish Gas Board attached to undertakings in the Lanarkshire Division were each presented with an award for 40 years' service at a ceremony at Bothwell last month. The men, who received their awards from Mr. D. D. Burns, Deputy Chairman of the Board, were Mr. Charles McGrorty, Mr. James Black, Mr. David Newlands (all of Coatbridge District Undertaking), Mr. John W. Campbell, Uddingston; Mr. John Hamilton, Lanark; and Mr. J. R. Campbell, Hamilton.

The Audenshaw Works of General Gas Appliances, Ltd., was visited by the Yorkshire Women's Gas Federation (Leeds Group) on May 11. The party arived in Manchester by road and were welcomed at lunch by Mr. R. A. Smith (Director and General Manager). They then proceeded to the works to be shown the various stages and methods of gas cooker manufacture. Tea was taken at the works and on behalf of the members of the Group, the Chairman, Mrs. N. G. Appleyard, expressed appreciation and said how much the visit had been appreciated by the party.

A Residential Refresher Course for works and plant engineers is to be held under the auspices of the National Industrial Fuel Efficiency Service with the support of the Southern Regional Council for Further Education at the Clarendon Laboratory, Oxford, from September 26 to 30. There will be 15 sessions given by lecturers eminent in the field of fuel technology. A works visit is also included. The fees for the course will be £9 9s. inclusive of meals and accommodation at Brasenose College. Information about the course can be obtained from Mr. E. S. Watkin, Ailsa House, 181, Kings Road, Reading, Berks.

INFRA-RED HEATING FOR NEW STORE

Gas fired infra-red space heating panels have been installed in the new Woolworth self service store, Cobham, which was opened recently. The panels are placed above the counters so that the customers are always comfortable and warm. The panels were supplied by Thomas De La Rue & Co., Ltd.

Coke Marketing Scheme

A new marketing scheme for hard coke came into operation in North West England on June 13, having received the approval of the Ministry of Fuel and Power. The area (Lancashire, Cheshire, and part of the West Riding of Yorkshire) is divided into three zones. In each zone there is only one set of delivered prices. Retail prices vary only according to unit of delivery (1-10 cwt., 11-39 cwt., and 2 tons and over), whether delivery is in bags or loose; and whether it is in an urban or a rural area. There are contract prices for consumers taking large quantities over 50 tons and over 500 tons per annum in regular deliveries, and certain premiums for special qualities.

A summer-winter price scheme for hard coke has also been introduced. There is a reduction of 7s. 6d. per ton on the basic prices up to August 31. During September and October the basic prices will apply, and from November 1 until the end of April, 1956, there will be an increase of 5s. per ton. The basic prices are subject to alteration in the event of any major change in production or distribution costs.

Coke sold to blast furnaces and foundries is excluded from the schemes, both of which will operate for a trial period of one year.

William Press & Son, Ltd., announce that the address and telephone number of Mr. H. G. Mills is now 32, Queen Anne's Gate, S.W.1. (T/N. Whitehall 5731, seven lines).

Fire Protection in office buildings is the subject of a booklet issued by the Fire Protection Association, 15, Queen Street, London, E.C.4, which will be supplied free on application. Every office, says the Association, should have a carefully thought out set of instructions covering the procedure, and the booklet gives the essential points.

Fourth British Food Fair

More than 407,400 people visited the third British Food Fair in 1954. Every available foot of space was sold well in advance. The fourth Fair at Olympia from August 28 to September 15 next year, 1956, will be even bigger and better; bigger in that certain modifications in design will allow the overall stand area to be increased, and better in that the period of the Fair has been extended by six days.

Extension of the tenancy from 11 working days in 1954 to 17 working days in 1956 was made imperative by the success of the 1954 Fair, which became, at times, rather too crowded for the comfort of either the exhibitors or the public. The 1956 Fair is under the publicity sponsorship of the *Daily Express*. The prospectus will be sent out at the beginning of July and the allotment of space commences on September 3 this year. The Fair is promoted by the Food Manufacturers' Federation and organized by J. F. B. O'Shea, M.C., F.R.S.A., 290, Minster House, St. James' Court, S.W.1.

The North Western Gas Board's magazine *Link-Up* has been awarded a Certificate of Merit for the second year in succession in the National House Journal Competition of the British Association of Industrial Editors. The issues of the magazine submitted for the competition were the February and March issues which were published during a gap in the Editorship. The award places the magazine among the top dozen industrial house magazines of its class in this country. The certificate was presented at the Association's annual convention at Stratford-upon-Avon on May 21.

KEEPING CARS AND CUSTOMERS WARM

Siaps Gas Radiants, Ltd., distributors of Schwank gas radiants in Great Britain, send us this photograph of the 'Fiesta' first drive-in restaurant in the United States having outdoor heat, recently opened for business at Milwaukee, Wisconsin. Through the use of Schwank infra-red radiant gas heaters that keep cars and customers warm, regardless of weather, the 'Fiesta' will operate all the year round.

Company News

SAUNDERS VALVE

Net profit of the Saunders Valve Co., Ltd., and its subsidiaries for the year ended April 30 (in the case of Goulds Foundries, Ltd., from the date of acquisition, February 11, 1955), amounted to £256,031 (£204,303 for 1953-54). Taxation, other than profits tax on distribution, absorbed £117,219 (£117,222), leaving available profit of £138,812 (£87,081); £250,000 (nil) is transferred to general reserve and £42,400 (£50,661) is appropriated to write off goodwill (Goulds Foundries, Ltd.). It is proposed to pay a final dividend of 14% making a total distribution for the year of 20%.

GIBBONS (DUDLEY), LTD.

The report and accounts for the year ended December 31, 1954, of Gibbons (Dudley), Ltd., show a Group net profit, after tax, of £165,285. Brought forward from 1953 was the sum of £49,446, making an available total of £214,731. Deductions for the parent Company are: General reserve, £40,744, and employees' benefit fund, £7,000, amounting to £47,744. Deductions for Gibbons Bros., Ltd. (subsidiary), are: Write off shares in its subsidiary companies, £52,323, and general reserve, £30,000, totalling £130,067. The dividends recommended or paid are, preference at 7% (free of tax) for year, two ordinary interims at 5%, less tax), and an ordinary final at 6%, less tax, on the increased capital. These dividends amount to £24,770, and £59,894 is left to carry forward.

COALITE & CHEMICAL

After allowing for taxation amounting to £263,886 the net profits of Coalite & Chemical Products, Ltd., for the year ended March 31 amounted to £238,650 compared with the record of £265,552 in 1952 and £183,267 last year. An interim dividend of 3% has been paid and the annual meeting will be asked to approve a final dividend of 8%, leaving £116,373 to be carried forward. Commander C. Buist, Chairman, in his statement, refers to the Government's promised Clean Air Bill and says the problem before the company is how to provide sufficient 'Coalite' to cope with the ever-increasing demand. Three new batteries at Bolsover should be in production by the turn of the year and it is planned to build a further three on the same site. Substantial additions and modifications to the ancillary plant are required in consequence. The resultant increase in the output of crude oil and spirit will necessitate expanding the capacity of the central refinery. In addition, and following the work of the research department, it is planned to install a series of new refinery units which will increase the range of chemical products. It is estimated that the capital cost of this programme of expansion will approach £900,000. At the end of 1956, the Bolsover plant will be nearly three times its original capacity and the two 'Coalite' works together will be carbonizing approximately 720,000 tons of coal per annum.

SIDNEY FLAVEL

The Board of Sidney Flavel & Co., Ltd., announces that it is proposed to declare an interim dividend of 6%, less tax, in respect of the year ending July 31, 1955. Dividend warrants will be posted on June 30, payable July 1, 1955. The transfer books will be closed from June 6 to June 18, 1955, inclusive. In making this declaration, the Board desires it to be known that the profits for the current financial year will be less than those for the previous year. The contraction in profits is due to: (a) Higher costs; (b) reorganization and development expenses in connection with the introduction of new appliances; (c) unsatisfactory production at the heavy castings foundry; and (d) a considerable fall in the demand for gas appliances occasioned by the introduction, in February, of hire-purchase restrictions.

DRAKES LTD.

The report of the directors of Drakes, Ltd., shows that the Company made a net profit for the year ended December 31, 1954, of £11,047. The amount brought forward from last year was £56,977, making a total of £68,024. After deducting preference dividend and transfer to general reserve, £41,704 was left available for appropriation. The Directors recommend that this be appropriated as follows: A dividend of 10%, less income tax, on the ordinary shares, totalling £4,675, leaving a balance to be carried forward of £37,029. The Chairman, Mr. John A. Drake, said in his statement: 'The financial results of the Company for the year ended December 31 last, show that the fall in profits which has been evident for the last few years has been halted, and this year there is a slight increase in the net profit, but I would point out that in a Company carrying out large constructional contracts such as your Company does, the profits year by year can be affected very considerably by the number of contracts in progress at the end of the year. Owing to the policy of turning your Company into a holding company with operating subsidiaries, and if things go according to plan, 1955 will probably see the completion of trading by the parent company, it has become difficult to give a true comparison between this year and last year, but removing all duplication by inter-company trading, the sales outside the group this year show only a small reduction compared with last year, and the percentage of work done by the subsidiaries for other companies outside the group, is increasing year by year.' He continued, 'During the course of the year, large orders have been exceedingly scarce in the gas industry, and while there is a reasonable order book for 1955, every endeavour is being made to obtain work in other industries apart from gas. In the engineering subsidiary, particularly in the foundry, a large proportion of the work is being undertaken for the machine tool industry, indirect work for the National Coal Board, and plant for the drying of various commodities, etc.'

BELL'S ASBESTOS

Mr. C. W. Bell, Chairman of Bell's Asbestos & Engineering (Holdings), Ltd., in his statement with the accounts for the year to December 31, said: 'The Group's net profits, before taxation, have recovered from £508,011 to £531,946. Thus, with the level of taxation virtually unchanged and provision being made for it at £291,999 against £295,575, and after deducting £4,797 attributable to minority interests and to preference shareholders of a subsidiary company, a figure of £235,150 net profit is achieved as against the previous year's £204,825. With £277,445 brought forward from 1953 and after deducting (*a*) £19,429 again transferred to reserves by subsidiary companies and (*b*) £50,000 likewise to general reserve by the Holding Company, increasing the total to £250,000, and after payment of dividends on both classes of preference shares as well as the interim dividend of 5%, less tax, on the ordinary shares, there remains a Group balance of £415,102. Having regard to the improved results your directors recommend the payment of a final dividend on the ordinary shares of 12½%, less income tax; the decision to do so will absorb £39,909, leaving no less a sum than £375,193 to be carried forward by the Group as compared with £277,445, namely, £205,810 by the Holding Company and £169,383 by subsidiary companies.'

GLOVER & MAIN

The annual general meeting of Glover & Main, Ltd., was held on May 26 in London. Colonel W. R. Glover, C.M.G., D.S.O., the Chairman, presided. The group trading profit for the year ended December 31, 1954, after deducting all expenses, amounted to £749,578, as against £547,425 in the previous year, and together with investment income, totalled £783,671, compared with £579,614. The net profit of the group for the year, after taxation, totalled £371,341. The final dividend recommended on the ordinary capital was 3s. 6d. per share, with a bonus of 1s., making, with the interim paid of 1s. per share, a total of 5s. 6d. for the year. The Chairman, in his statement, referring to Thomas Glover & Co., Ltd., said that although on the meter side they had not beaten all records, they had made an increase in their production over last year. R. & A. Main, Ltd., had had a record year. The No. 20 'Century' cooker had been in production for over two years and they had made over 250,000 of this type alone. During the year they had introduced another popular model—the 'Economain'—at a lower cost, but based on the same general principles. Main Water Heaters Ltd., also had a record year. They were extending and modernizing their work and hoped to reap the benefit of this in 1956. Total sales by Main Enamel Manufacturing Co. were up 25%. Main Refrigeration, Ltd., had not made the initial progress which they had hoped

went on Colonel Glover. There had been technical difficulties to be overcome and considerable delay had been experienced as the suppliers of specialized components could not meet their requirements. 'We are now making these ourselves, and have been in limited production for some months. We are increasing the size of our pilot plant and this will give us additional output until we have built a new factory which is now being planned,' he said.

WOODALL-DUCKHAM

The following are extracts from the statement by Mr. T. C. Finlayson, Chairman of Woodall-Duckham, Ltd., to the 7th annual general meeting of the Company: 'The value of work carried out during the year ended December 31, 1954, by the operating companies of the Group, exceeded £14 mill.—an increase of 17% over the 1953 figure—thus constituting a new record. Although new orders received in 1954 did not reach this figure—being approximately £8,300,000—unexecuted orders at the end of the year still exceeded £25 mill. thus, without allowing for new orders, ensuring full employment of the Group's organization for the next two years. The consolidated profit and loss account for 1954 shows a profit subject to taxation of £1,039,932 compared with £951,610 for the previous year. This result reflects the large turnover of the Company, but despite the relief afforded by the disappearance of the Excess Profits Levy the impact of taxation has again been heavy, amounting to £580,237 compared with £654,022 in 1953. After providing for taxation and deducting the proportion of profits applicable to outside interests of £23,912, the Group net profit is £435,783 compared with £271,518 for the previous year. Out of the Group net profit of £435,783 profits amounting to £226,828 were retained in the subsidiary companies (compared with £58,320 in 1953), and a sum of £100,000 set aside for research and development, leaving a net amount of £108,955 brought into the parent company's accounts. The preference dividend for the year has been paid. Your directors recommend a final dividend of 20% on the ordinary shares which with the interim dividend paid on December 31, 1954, gives a total ordinary dividend of 25% for the year. This represents an increase of 5% in the total rate of ordinary dividend and is payable on the increased ordinary capital. As already mentioned, the volume of orders received by the Group during 1954 was, as in the previous year, less than the value of work carried out during each of those years. The uncertainty regarding the supply of suitable coal to the gas and coking industries continues to act as a source of discouragement to the launching by these industries of schemes involving large capital outlay. During the past two years there has been a definite search by the gas industry to find new methods of producing town gas. Your principal operating company has, therefore, still further expanded its field of work to enable it to meet these changing requirements of the gas industry.

NEW LOW-PRICED COOKER

The 'Economain' Cooker

Because of its low price and economical gas consumption the Main No. 109, latest addition to the range of cookers by R. and A. Main, Ltd., has been named the 'Economain.' The 'Economain' is said to have the qualities of a luxury model, its highly efficient cooking performance and pleasing modern design making it the equal of many a more expensive cooker. Already in quantity production, it is rapidly increasing in popularity.

It is strongly constructed of stamped steel and finished throughout in high-gloss cream and black vitreous enamel. Four fast-boiling burners and a grill burner are provided, each having a rating of 12,000 B.Th.U. per hour. The hobplate and all hotplate parts are finished in black vitreous enamel, the one-piece removable hobplate being recessed to accommodate the pan supports which are cast in pairs and are interchangeable and reversible. The boiling burners are also cast in pairs and interchangeable. Pan supports and the grill burner are finished in special heat and acid resisting vitreous enamel.

The quick-heating grill is of generous proportions and is fitted with heat-resisting grill frets and a deep enamelled cover. The grill pan is in black vitreous enamel and is complete with two-height close meshed tinned wire grid. The oven crownplate is also finished in vitreous enamel and is dished to act as a fixed spillage tray.

All burners have independent safety control taps with fixed injectors and black plastic control knobs. The 'Mainstat' control knob and oven door handle are also of black plastic. The splash-plate is of pressed-steel, finished in vitreous enamel, and the platerack can accommodate 16 plates on edge.

An aluminium pressure governor, a 'Mainstat' front reading oven thermostat and a gas lighter connection are included in the standard specification.

Oven Details

The oven, which has a side hinged door, is fitted with a single burner, situated at the rear, having a rating of 10,000 B.Th.U. per hour. A flash ignition tube is provided for easy lighting, the lighting hole being in the front of the oven base-plate. Inside measurements of the oven are 17 in. wide by 15¼ in. deep by 15½ in. high and its lining is finished in grey vitreous enamel. All corners are smoothly rounded and the sides are embossed to provide runners for the two plated grid-shelves. A tinned meat pan and a stoved black cake tray are also provided with the cooker.

Ease of dismantling and re-assembly of the hotplate and the overall vitreous enamelled finish of the cooker have reduced cleaning problems to a minimum commensurate with its low cost. The oven, with its well rounded corners and complete absence of projections, is extremely easy to clean.

Standard finish is cream with black hotplate and fittings and a black, tubular platerack with supporting wires. A cream vitreous enamelled pressed-steel platerack with black supporting wires can, however, be obtained at a small extra cost. Optional extras are a separate spillage tray and vertical flue extension.

A dapple grey model is also available for offer against electrical competition for bulk orders for houses estates, etc.

Newtownards Gas Charges

Reviewing the finances of the Gas Department at a meeting of Newtownards Borough Council, the retiring Mayor (Alderman Isaac Baxter) said rising costs and large capital expenditure compelled the Committee to recommend an increase in the price of gas to 7s. 6d. per 1,000 cu.ft., which, however, was one of the lowest charges in Northern Ireland, and vindicated the far-sighted policy of the Gas Committee in installing the new vertical retorts a number of years ago. Since then the policy of modernization had been proceeded with, and a laboratory had been provided ,while two additional purifiers were under construction, and gas mains had been extended and renewed in some parts.

Some additional plant had still to be provided, notably a gasholder and a static washer, as well as the replacement of a number of smaller mains, and the provision of these, together with the elimination of the bank overdraft (which had been considerably reduced in the past few years) would require attention. The suggested integration of the Bangor and Newtownards gasworks was being investigated.

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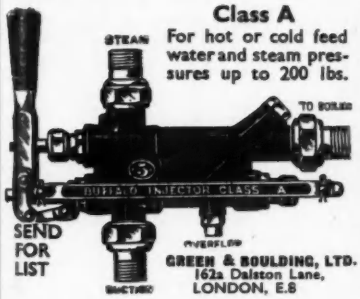

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THE BRITISH GAS PURIFYING MATERIALS CO., LTD.

NATURAL BRITISH.

BOG (DUTCH and DANISH) ORE.

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PUBLICATIONS

GAS ACCOUNT CALCULATORS

SUPPLIED either by Price per Therm or Thousand, for any specified Calorific Value, in book form, office charts, or pocket charts for Meter Inspectors, printed in clear type. Write for particulars to F. H. WAKELIN, LTD., Calculator Specialists, 354, WHEELER STREET, BIRMINGHAM.

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APPOINTMENT WANTED

REPRESENTATIVE, fully experienced, recommended by Past President, desires change of Post. Connections with Sales and Distribution sides of the Industry—part-time Representation considered. Apply: No. 246, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

APPOINTMENTS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is exempted from the provisions of the Notification of Vacancies Order, 1952.

A LEADING firm of Manufacturers require DEPARTMENTAL MANAGER for their Portable Appliance and Brass Gas Fittings section. Applicants must have good commercial knowledge, organising ability and initiative, and be responsible for development of sales. Good salary for the right applicant, who must be over 35 years of age. Apply: No. 245, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

SCOTTISH GAS BOARD

WESTERN GROUP
TECHNICAL ASSISTANT

APPLICATIONS are invited for the position of TECHNICAL ASSISTANT in the above Group.

Applicants should be fully experienced in the control of Vertical Retorts and should possess the Higher Grade Certificate of the I.G.E. or equivalent qualification.

The salary will be within Grade A.P.T. IX Provincial "A" (£700-£800 per annum) with placing according to qualifications and experience.

A rented house will be made available if required.

The post is superannuable and the successful candidate may be required to pass a medical examination.

Applications stating age, qualifications and experience, together with names of two referees, should be submitted to the undersigned not later than Saturday, July 2, 1955.

ALEX. JAMIESON,
Group Manager.

'Kessington,'
29, Union Street,
Greenock.

SCOTTISH GAS BOARD

FIFE GROUP
KIRKCALDY DISTRICT
DISTRIBUTION TECHNICAL ASSISTANT

APPLICATIONS are invited from suitably qualified technical assistants for the above position, on APT Grades 1/6, i.e., with a maximum on Grade 6 of £645 per annum. Qualified draughtsmen may be considered for the position, provided they are willing to learn technical distribution practice. Placing on the above grades will be according to experience and qualifications.

The person appointed will be required to prepare drawings, quantity sheets, estimates, and specifications in connection with all such work.

The successful applicant will be required to pass a medical examination, and to subscribe to the Board's Superannuation Scheme.

Applications, endorsed "Distribution Technical Assistant," stating age, qualifications, and experience, and accompanied by a *copy* of each of three recent Testimonials, should be lodged with the Undersigned within fourteen days of this advertisement.

JOHN H. FULTON,
District Manager.

Scottish Gas Board,
Fife Group, Kirkcaldy District,
28, Links Street,
Kirkcaldy.
June 14, 1955.

SCOTTISH GAS BOARD

DEPUTY COMMERCIAL MANAGER

APPLICATIONS are invited for the post of DEPUTY COMMERCIAL MANAGER. Applicants must have organising and administrative ability. General commercial experience in the Gas Industry, or executive experience in large scale selling organisation would be of advantage. Salary on a scale £1,300-£1,600 per anum, with initial placing according to qualifications and experience. The post is superannuable, and the successful candidate may be required to pass a medical examination.

Applications giving age, qualifications and experience, together with names of two referees, should be addressed to the undersigned.

A. T. HERD,
Secretary,

Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh.

NORTHERN GAS BOARD

WESTERN GROUP
MECHANICAL ENGINEER
CARLISLE DIVISION

APPLICATIONS are invited for the position of MECHANICAL ENGINEER on the staff of the Carlisle Division.

Salary within Grade APT. 9 (£700-£800 per annum), placing according to age and experience.

The successful candidate will be required to pass a medical examination and join the Board's Staff Pension Scheme.

Applications stating age, experience and giving full details of training and qualifications, together with the names of two referees, should be addressed to The Divisional General Manager, Gas Works, Rome Street, Carlisle, to arrive not later than Saturday, July 2, 1955.

A. R. CROFT,
Group General Manager.

50, Castle Street,
Carlisle.
13.6.55.

EAST MIDLANDS GAS BOARD

LEICESTER AND NORTHANTS DIVISION
SENIOR TECHNICAL ASSISTANT
(DISTRIBUTION)—NORTHAMPTON GROUP

APPLICATIONS are invited for the position of SENIOR TECHNICAL ASSISTANT to the Group Distribution Engineer at Northampton. The commencing salary will be within the range £620/740 per annum according to age and experience.

Applicants must at least hold the Ordinary Grade Certificate in Gas Engineering (Supply), should have a thorough knowledge of modern methods of distribution, including high and low pressure systems, and be capable of carrying out the detail work in connection with the planning and estimating of new work.

The post is pensionable and the successful applicant may be required to pass a medical examination.

Applications, stating age and experience and giving full details of training and qualifications, together with the names of two referees, should be submitted to Mr. E. B. Craddock, Group Manager, 45, Abington Street, Northampton, not later than July 1, 1955.

H. B. TAYLOR,
Divisional General Manager.

Leicester.
June 10, 1955.

EAST MIDLANDS GAS BOARD

LINCOLNSHIRE DIVISION
HOME SERVICE ADVISER OR TRAINEE—
SCUNTHORPE

APPLICATIONS are invited from suitably qualified persons for the above appointment. Candidates must hold a recognised Certificate in plain cookery and/or domestic science and be capable of promoting the use of gas appliances and of advising consumers on kitchen and other domestic problems involving the use of gas.

Consideration will be given to accepting a young lady as trainee providing she has successfully completed a course of study in domestic science.

The salary will be within Grades APT. 2/5 (female) of the National Salary Scales (£293/£494 per annum) according to qualifications and experience.

The successful candidate will be required to pass a medical examination and will also be required, if eligible, to join the Board's Staff Pension Scheme within six months of taking up the appointment.

Applications stating age, qualifications and experience and giving full particulars of training, together with the names of two referees should be addressed to the undersigned to arrive not later than July 2, 1955.

B. CLARKE,
Divisional General Manager.

Belle Vue House,
Carline Road,
Lincoln.

(Classified advertisements continued on page 864)

APPOINTMENTS VACANT (ctd.)

TECHNICAL Assistant required for development work on controls for the Gas Industry. Age 20-24. National Service completed. Qualified or studying for H.N.C. or similar background. Apply with full particulars to Technical Manager, Engineering Division, Evered & Co., Ltd., Surrey Works, Smethwick 40.

TECHNICAL Assistant required in the Manchester District for work on the development of gas appliances, primarily domestic cookers. The applicant should possess a keen interest in physics and/or chemistry. Continuation of studies will be encouraged.

The salary offered will depend on the qualifications of the applicant. Apply: No. 247, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

METROPOLITAN GAS METERS, LIMITED, Forest Street, Hyson Green, Nottingham, have a vacancy for a WORKS MANAGER at the main Nottingham Works employing between 2 to 3 hundred. Applicants preferred with an all round knowledge of Gas Meter production and should have first-class practical and theoretical experience in modern production methods. Good opportunity for the right type of man. Successful applicants will be required to pass a medical examination in connection with the Pension Scheme. Salary offered will be commensurate with qualifications. Reply giving full details of education, experience and qualifications, also stating age.

OLD established Company manufacturing domestic and industrial gas appliances requires:

1. Junior Sales Representative for Greater London area.
2. Junior Sales Representative to call on Gas Undertakings controlled by Southern Gas Board.
3. Representative to call on Gas Undertakings controlled by South Western Gas Board and Wales Gas Board.

The position can be permanent, progressive and pensionable. A car and normal travelling expenses will be provided. Applicants are invited to submit fullest details, which will be treated in strict confidence. Apply: No. 248, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

SOUTH EASTERN GAS BOARD

GAS ENGINEERING DRAUGHTSMAN,
ROCHESTER
KENT COUNTY DIVISION

CANDIDATES must have had drawing office experience of structural steel work and steel and cast iron pipe work and be capable of preparing detailed working drawings.

Salary within Grades 6-7 (Prov. 'A') £565-£700 p.a., according to qualifications and experience.

Applications in writing, quoting reference V10/535 and giving full details, should reach the undersigned within fourteen days.

R. J. McCRAE,
Personnel Manager.

Katharine Street,
Croydon.

EASTERN GAS BOARD

WATFORD DIVISION
CHEMICAL STAFF APPOINTMENTS

APPLICATIONS are invited for the following appointments:—

1. Works Chemist, St. Albans.
2. Assistant Works Chemist, St. Albans.
3. Assistant Works Chemist, Luton.

Candidates should have some practical experience, not necessarily in the Gas Industry, and commencing salary will be within the range £385 to £665 (Grades A.P.T. 4, 5 or 6) for Assistant Works Chemist and within the range £585 to £760 (Grades A.P.T. 6, 7 or 8) for Works Chemist. An approved qualification will command a higher commencing salary in the Division's grading scheme for chemical staffs.

Training will be given to successful applicants who have no previous experience in the Gas Industry and facilities will be given in approved cases to those desirous of proceeding to higher professional qualifications. There are excellent prospects for advancement in the Industry generally and in particular in this Division, where expansion of business demands an increasing number of technicians in process and specialist departments.

The persons appointed may be required to pass a medical examination and, unless already subject to a Pension Scheme by virtue of the Gas (Pension Rights) Regulations, 1950, will be required, if eligible, to join the Board's Staff Pension Scheme within six months from taking up the appointment.

Write to the Divisional General Manager, Eastern Gas Board, Radiant House, Clarendon Road, Watford, giving age and full details of education and experience, not later than July 11, 1955.

ENGINEER. Young qualified engineer required as assistant to Managing Director of Midland works. Near future advancement in expanding business for capable administrative engineer. Write: No. 244, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

FORD MOTOR COMPANY, LIMITED, of Dagenham, Essex, are making industrial history again. We have a vast expansion scheme under way which has created the following opportunity in our Construction Engineering Department.

An Assistant Engineer is required for project work on Gas Holders, Boiler Installations and general engineering. To qualify for this job you will need an A.M.I.Mech.E. backed by at least five years' experience of site erection and supervision.

Does this opening appeal to you? Then our Salaried Personnel Department will be glad if you will write to them. Your starting salary will reflect your experience and qualifications and our excellent non-contributory pension will take care of your future security. Please quote reference KGA.

NORTH EASTERN GAS BOARD

HULL GROUP
BANKSIDE WORKS, HULL
WORKS CHEMIST

APPLICATIONS are invited for the above position at a salary within Grade A.P.T. 8 (Provincial 'A') (£660-£740 per annum) of the Salary Scales agreed by the National Joint Council for Gas Staffs.

Candidates should be capable of carrying out all laboratory work necessary at a Gas Works and should preferably have a qualification in Chemistry. The successful applicant will act as chief assistant to the Senior Chemist.

The successful applicant will be required to pass a medical examination and to join the Board's Staff Pension Scheme.

Applications giving age, experience and qualifications should be sent to the Group General Manager, North Eastern Gas Board, Hull Group, Bankside Works, Sculcoates, Hull, so as to arrive not later than Wednesday, July 6, 1955.

J. C. GARDNER,
Secretary.

SOUTH WESTERN GAS BOARD

SWINDON DIVISION
INDUSTRIAL GAS ENGINEER

A SUITABLY qualified person is required to develop industrial gas sales and to organise the installation and maintenance of all types of industrial appliances.

Applicants should have had wide experience of this work and preferably be members or Associate Members of the Institution of Gas Engineers.

Salary within Grade APT 10 (Prov. 'A') £760-£860.

The successful candidate will be required to pass a medical examination and subject to any pension rights he may now possess, to join the Board's Staff Pension Scheme, if eligible.

Applications stating age, experience and qualifications together with the names of two referees to be forwarded to the undersigned not later than Wednesday, July 6, 1955.

W. B. CLARIDGE,
Divisional Engineer and Manager.

43, Regent Street,
Swindon.

SOUTH WESTERN GAS BOARD

BRISTOL/BATH DIVISION
APPOINTMENT OF INDUSTRIAL GAS ENGINEERS

APPLICATIONS are invited from suitably qualified persons for the following appointments in the Industrial Gas Department, Bristol.

(1) CHIEF INDUSTRIAL GAS ENGINEER

Applicants must be Corporate Members of the Institution of Gas Engineers and have a wide experience of Industrial Gas installations and maintenance. The successful candidate will be responsible to the Divisional Engineer and Manager for the development of Industrial Gas sales and organisation and control of the Industrial Gas Department.

(2) SENIOR INDUSTRIAL GAS ENGINEER

Applicants should have a wide experience of Industrial Gas installations, and preferably be Corporate Members of the Institution of Gas Engineers.

The salaries for the appointments will be:—

(1) CHIEF INDUSTRIAL GAS ENGINEER, within the range of £835 to £1,100 per annum.

(2) SENIOR INDUSTRIAL GAS ENGINEER, £785-£910 per annum. Commencing at a figure commensurate with qualifications and experience.

Applications giving details of experience, qualifications and appointments held, accompanied by the names of two referees, should be forwarded to the undersigned not later than Saturday, July 9, 1955.

T. N. Dent, A.M.I.Mech.E., M.Inst Gas E.,
Divisional Engineer & Manager,
Bristol/Bath Division,
South Western Gas Board,
Radiant House,
Bristol, 1.
18/6/55.

EXPERIENCED Contractor's Agent required, Permanency; for supervision of Gas and Water Mainlaying Contracts. Home Counties. Accommodation. State age, salary, full experience. Apply No. 243, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

NORTH WESTERN GAS BOARD

EAST LANCASHIRE GROUP
SHOWROOM MANAGER—BLACKBURN SHOWROOMS

APPLICATIONS are invited for the above pensionable position at a salary within Grade APT 7 (£620-£700 per annum).

Applicants must have had experience of showroom supervision and sales, and preference will be given to holders of the Institution of Gas Engineers' Certificate in Gas Salesmanship and Consumer Service.

Detailed applications, giving the names and addresses of two referees, should reach the General Manager, N.W.G.B. (East Lancashire Group), Cardwell Place, Blackburn, within 14 days.

SOUTHERN GAS BOARD

BOURNEMOUTH GAS UNDERTAKING
TECHNICAL ASSISTANT—DISTRIBUTION

APPLICATIONS are invited for the position of TECHNICAL ASSISTANT in the Distribution Department of the Bournemouth Gas Undertaking.

Applicants should have had practical experience with installations on domestic and commercial premises and should hold the Institution of Gas Engineers' Ordinary Grade Certificate (Supply) or its equivalent.

The salary will be in accordance with Grade APT 6 (Provincial 'A') of the Salary Scales of the National Joint Council for Gas Staffs, i.e., within the range £565 to £645 per annum, according to qualifications and experience.

The successful applicant will be required to pass a medical examination and, unless already subject to a Pension Scheme by virtue of the Gas (Pension Rights) Regulations, 1950, will be required to join the Board's Staff Pension Scheme.

Applications giving full particulars of age, training, experience and qualifications, should reach the undersigned on or before July 8, 1955.

J. C. HOGG,
General Manager.

Bournemouth Gas Undertaking,
136, Old Christchurch Road,
Bournemouth.

SOUTHERN GAS BOARD

PORTSMOUTH, GOSPORT AND BOGNOR-REGIS GAS UNDERTAKING.
TECHNICAL ASSISTANT—DISTRIBUTION

APPLICATIONS are invited for the above post in the Distribution Department of the above Undertaking.

Candidates should be experienced in high and low pressure gas distribution practice together with the preparation of specifications, drawings, and estimates for distribution work. Considerable extensions, including bulk integration are taking place. The possession of a technical qualification in gas distribution would be an advantage.

The commencing salary will be within Grades APT V and VI (£530-£645) per annum on an appropriate step according to experience.

The successful candidate will be required to pass a medical examination and, unless already subject to a Pension Scheme by virtue of the Gas (Pension Rights) Regulations, 1950, will be required, if eligible, to join the Board's Staff Pension Scheme.

Applications stating age, qualifications and experience together with the names of two referees should be addressed to the undersigned to reach him not later than July 21, 1955.

H. M. LAWRENCE,
Engineer and General Manager.

Gas Offices,
The Square,
Portsmouth.
15/6/55.

The
LIMIT OF EFFICIENCY CAN BE REACHED
by the use of
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GAS PURIFYING MATERIAL
Sole Importers:
HARRISONS (London) LIMITED
66, Mark Lane, LONDON, E.C.3
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*THE RE-DESIGNED Western DOUBLE-FACED valve

British Patent Application No. 18092/53.

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Please write for Publication No. 52/5

W. C. HOLMES & CO. LTD

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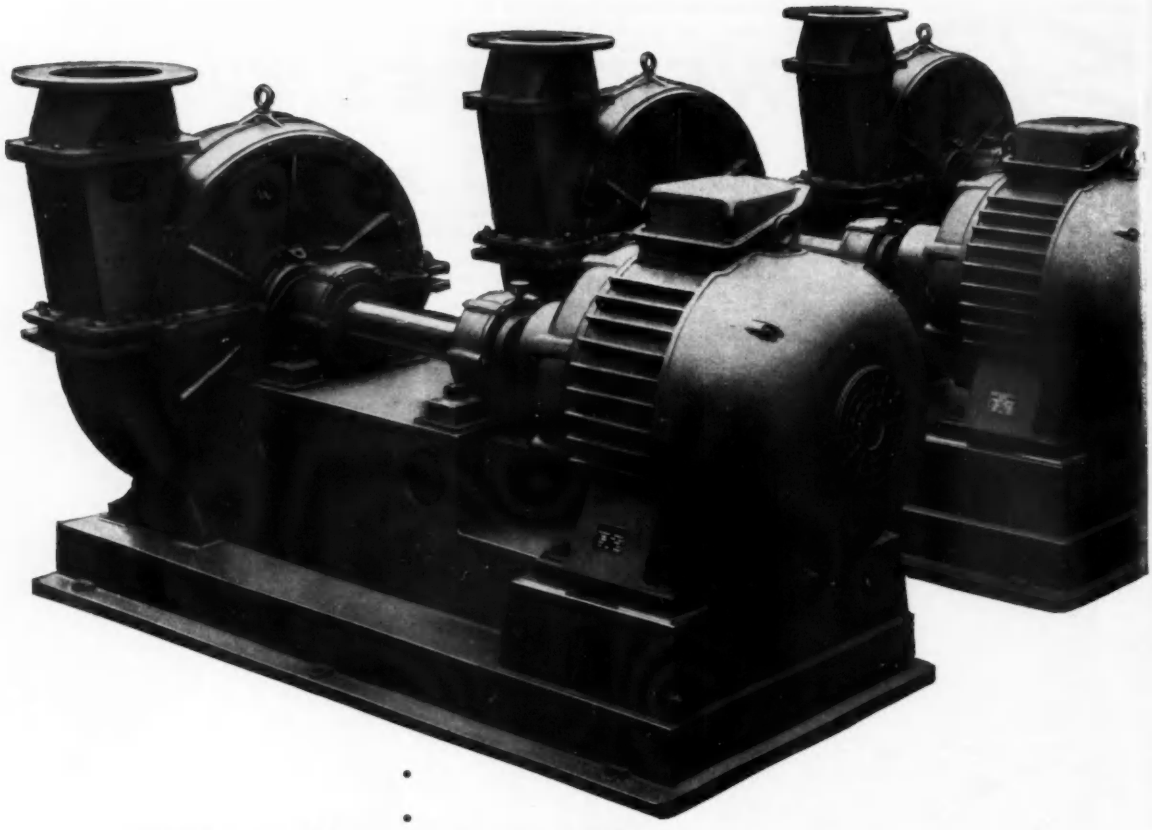
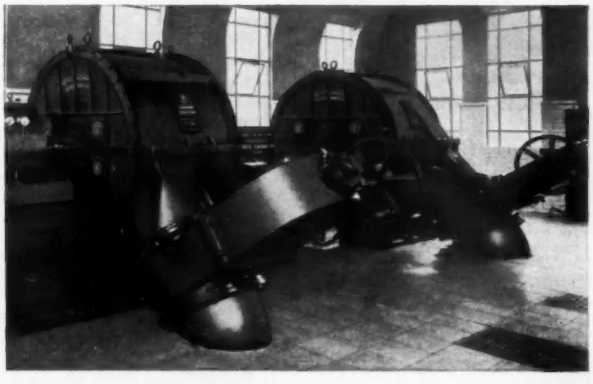


Gas Boosters?



EXAMPLES of gas boosting fans with cast iron casings are illustrated here. They represent the results of special attention to the design and development of robust, trouble-free boosters over the years. This experience provides fans for handling volumes of 5,000 to 1½ million cubic feet of gas per hour at pressures up to several pounds per square inch.
When the time comes you'll find there's no easier way to solve your air or gas moving problem than to put it to Keith Blackman.

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MILL MEAD ROAD · LONDON · N17 · TOTtenham 4522

T.A.7225/61

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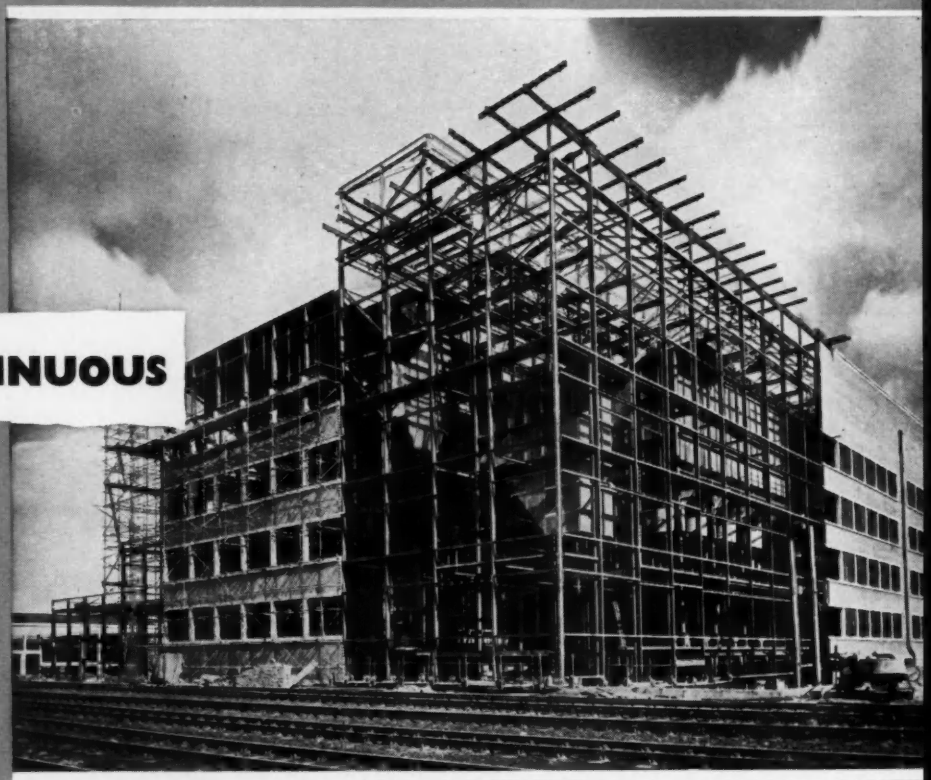
VERTICALS

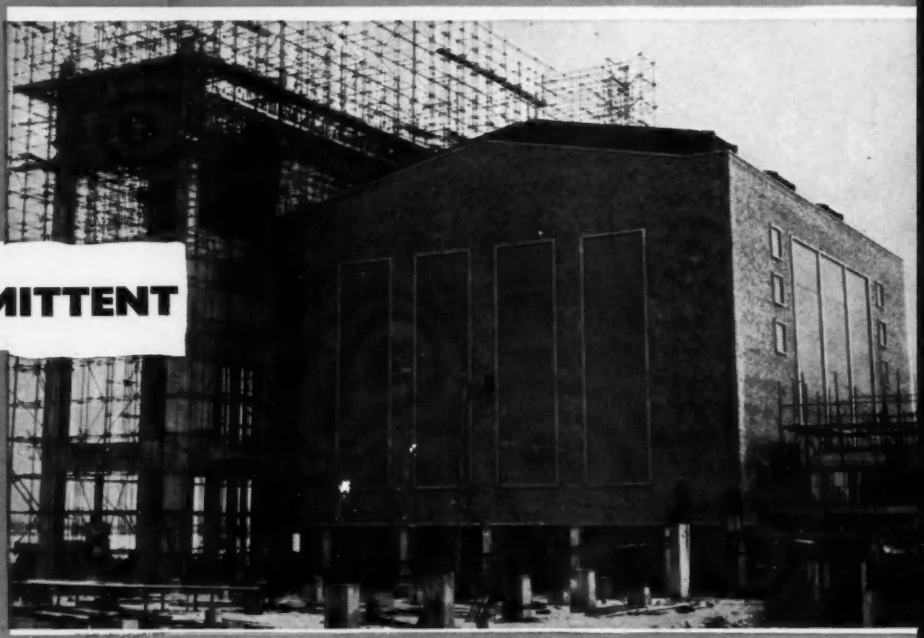
CONTINUOUS



Above:–
DENTON–An installation of 160 Glover - West Continuous Vertical Retorts at present under construction for the North Western Gas Board.

Below:–
PRESTON–Progress on the first half of the ultimate 8,000,000 cu. ft per day installation of C.O.L. Intermittent Vertical Chambers at Lostock Hall Works.

INTERMITTENT



Photographs by courtesy of the North Western Gas Board

WEST'S GAS IMPROVEMENT CO. LTD

ALBION IRONWORKS · MILES PLATTING · MANCHESTER 10 TEL: COLLYHURST 2961 GRAMS: STOKER, MANCHESTER
London: Columbia House, Aldwych, W.C.2. Tel: HOL 4108. Grams: Weagasco, Estrand. C.O.L. Div: Chandos House, Buckingham Gate, S.W.1. Tel: Abbey 6912

GC 5

Photograph by courtesy of Messrs. Schori Metallising Process Ltd.

"BROOMWADE" aids Industry

"BROOMWADE" pneumatic equipment plays a part in a grea. number of industries—many of them of considerable interest.

For instance, Messrs. Schori Metallising Process Ltd. spray a great variety of Metals and Plastics for the protection of Iron and Steel against all sorts of corrosive conditions—the process, being applicable to articles of any shape and size, can be carried out in the workshops or in situ.

Before spraying, all items are thoroughly shot blasted. Both processes use air supplied by "BROOMWADE" air compressors. Two batteries are installed, comprising three type EH.241 and four type D.23 machines.

All over the world, in all types of industries "BROOMWADE" is aiding new development, new processes . . . and is lowering costs.

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